OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

OLUME 44, NO. 23
OVEMBER 7, 1955

AMERICAN

DYESTUFF REPORTER

Devoted to Textile Chemistry
BLEACHING · DYEING · PRINTING · FINISHING

CUPROPHENYL BROWN GL BROWN 2RL

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A BROAD RANGE OF FASHION BROWNS AND TOP-NOTCH PERFORMANCE, TOO!

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VAT COLORS that never let you down!

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Hilton-Davis offers 3

hiltone red DCX

FASTNESS PROPERTIES	1:5	1:25	1:100
Light Fastness	60 hours	40 hours	40 hours
Plisse	Satisfactory	Satisfactory	Satisfactory
Fusing	Satisfactory	Satisfactory	Satisfactory
No. 4 AATCC Wash Test	Passes	Passes	Passes
AATCC Dry Cleaning Test	Passes	Passes	Passes

Approximate Weight Per Gallon 7.7 lbs

hiltone red G

FASTNESS PROPERTIES	1:5	1:25	1:100
Light Fastness	40 hours	20 hours	20 hours
Plisse	Not satisfactory	Not satisfactory	Not satisfactory
Fusing	Slight stain	Slight stain	Slight stain
No. 4 AATCC Wash Test	Passes	Passes	Passes
AATCC Dry Cleaning Test	Passes	Passes	Passes

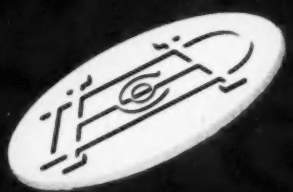
Approximate Weight Per Gallon 7.8 lbs

hiltone red BLC

FASTNESS PROPERTIES	1:5	1:25	1:100
Light Fastness	100 hours	100 hours	100 hours
Plisse	Satisfactory	Satisfactory	Satisfactory
Fusing	Satisfactory	Satisfactory	Satisfactory
No. 4 AATCC Wash Test	Passes	Passes	Passes
AATCC Dry Cleaning Test	Passes	Passes	Passes

Approximate Weight Per Gallon 7.7 lbs

Samples and information on request from



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Manufacturers of Dyestuffs for the Textile Industry

FROM WICA

The Truth about 'Wash and Wear'

The public wants more and more *wash and wear* fabrics. It's a dynamic, exciting concept, and the public is buying.

Like many other textile innovations, *wash and wear* has its pitfalls. The public welcomes freedom from the ironing board, but it doesn't want to be asked to wear shapeless, hot, clammy, baggy clothing.

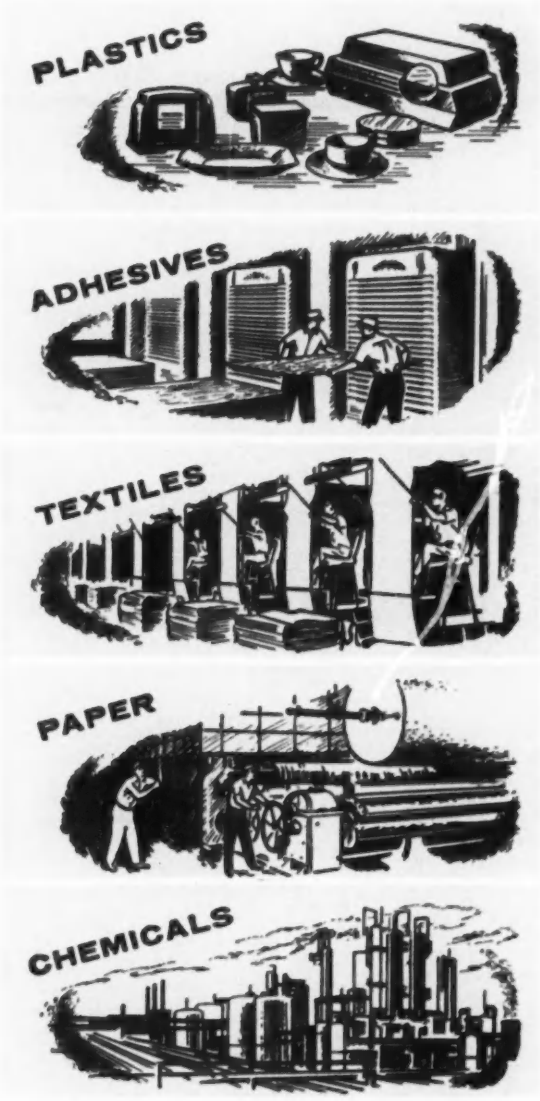
There are right and wrong ways to give fabrics a *wash and wear* quality. No one "patent medicine" exists to do this job. There are no shortcuts, no absolutes in the *wash and wear* field.

Sound chemistry can solve any *wash and wear* problem. But the plain truth is, each fabric and each use is a separate problem. As a basic manufacturer of products required for *wash and wear*, Wica has seen *wash and wear* assignments for years in its own laboratories. Wica has licked every problem so far. May we do the same for you?

WICA

DIRECT INQUIRIES TO: WICA CHEMICALS, INCORPORATED • OLD CONCORD ROAD • CHARLOTTE, N. C.

Heyden FORMALDEHYDE helps in Industry's BIG JOBS...



It is interesting to note that further growth is predicted for the major products made from Formaldehyde. This applies, for instance, to phenolic molding and laminating resins—urea and melamine resins for textiles, paper and plywood—and various organic chemicals.

Heyden Formaldehyde is helping in this growth, as it has right from the original development of these products. Experience, gained through this long association with customer problems, has enabled Heyden to meet the most exacting needs of each use. As new applications arise, Formaldehyde with the proper specifications will be available from Heyden.

Both methanol-inhibited (N.F.) and methanol-free forms of Formaldehyde are supplied by Heyden. If this chemical is one of your raw materials, why not discuss your requirements with the Heyden sales office nearest you.

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APPLICATION	DESCRIPTION	DESIGNATION
Antislip	FIBA WELD A	Water-Dispersible Resin
Antislip	FIBA WELD B	Water-Soluble Formaldehyde Condensate
Antislip	FIBA WELD PJ	Polymer Blend
Antistatic	CATEX	Quaternary Ammonium Product
Antistatic Agent	MOLLISAN	Non-Ionic Ester Type
De-embrittling Agent	MOLLISAN	Non-Ionic Ester Type
Dispersant	N S A E	Sodium Alkylnaphthalenesulfonate
Dispersant	MAPROFIX	Sodium Lauryl Sulfate
Dispersant	NEUTRONYX 400	Aromatic Polyglycol Ether
Dispersant	XYNOMINE	Sodium Amide Sulfate
Dye Fixative	XYNO FIX FL	A Complex Nitrogenous Condensate
Dye Fixative	XYNO SET B	An Imidazoline
Dyeing Assistant	ALIPHATIC ESTER SULFATE	Anionic Dyeing Assistant
Dyeing Assistant	N S A E PASTE	Sodium Alkylnaphthalenesulfonate
Dyeing Assistant	DARONYX	Dispersible Swelling Agent
Finishes		
Bodying	XYNO RESIN 362	Thermoplastic Synthetic Resin
Bodying	XYNO RESIN X99	Thermoplastic Synthetic Resin
Bodying	XYNO PERM 1591-60	Water-Soluble Protein
Crush-Resistant	N C F PASTE	Urea-Formaldehyde Resin
Crush-Resistant	LIQUID RESIN 55	Water-Soluble Urea-Formaldehyde Resin
Crush-Resistant Component	XYNO RESIN G-36	Aqueous Solution, Modified Urea-Formaldehyde Resin
Duller	DULLATONE CA	T_iO_2-Base Cationic Dispersion
Duller	DULLATONE 60	T_iO_2-Base Anionic Dispersion
Duller	DULLATONE AN 25	Resinated Dulling Agent
Fire Retardant	REPEL-O-FLAME SP	Mixture of Inorganic Salts
Hosiery Finish	ETERNALURE	Aqueous Dispersion of Synthetic Resin
Mildew Proofing	CATEX	Quaternary Ammonium Product
Mildew Proofing	ISOTHAN Q-15	Heterocyclic Cationic Complex
Moth Proofing	LARVONIL	Silicofluoride Salt
Ribbon Finish	XYNO RIBBON FINISH R	An Alkyd Resin
Sewability	XYNO FINISH 9909	Cationic-Nonionic Compounds
Shrink Resistant	CET	A Urea-Formaldehyde Derivative Resin
Taffeta Effects	XYNOTAF	Water Solution of Alkali-Soluble Alkyd Resin
Water Repellent Durable	REPEL-O-TEX ST	Silicone-Base Water Repellent
Water Repellent Durable	REPEL-O-TEX D3, D4	Heavy Metal Formate-Wax Emulsion
Water Repellent Renewable	REPEL-O-TEX 10-M	Aluminum Formate-Wax Emulsion
Softeners		
Anionic	VELVOSHEEN	Sulfonated Oil
Anionic	MAPROMOL HSY	Raw and Sulfated Fatty Alcohols
Cationic	ONYXSANS	Alkylimidazoline Hydroacetate
Heavy-Bodied	STEARYL GLYCERYL SULFATE N	Highly Sulfated Tallow
Non-Ionic	MOLLISAN	Non-Ionic Ester Type
Non-Yellowing	MOLLISAN	Non-Ionic Ester Type
Yellowing Resistant	XYNO FINISH 9909	Cationic-Nonionic Compounds
Gas Fading Inhibitor	NEUFUME DMX	Cationic Aromatic Amine Dispersion
Penetrant — Regular	PHI-O-SOL WA	Sodium Fatty Acid Ester Sulfate
Penetrant — Low Foaming	NEUTRONYX 311	Aromatic Polyglycol Ether
Scouring Agent	ONYXOL 9162	Fatty Acid-Alkanolamine Condensate
Scouring Agent	MAPROFIX	Sodium Lauryl Sulfate
Scouring Agent	MAPROTEX	Sulfated Fatty Alcohol Blend
Synthetic Detergent	NEUTRONYX 600	Aromatic Polyglycol Ether
Synthetic Detergent	SOROLENE G PASTE	Sodium Alkylnaphthalene-Sulfonate
Tar and Grease Remover	DEWAXIT	Self-Emulsifiable Solvent Mixture
Tar and Grease Remover	NEUTRONYX 834	Polyalkylene Ether Condensate of Fatty Acids
Wetting and Rewetting Agent	PHI-O-SOL WA	Sodium Fatty Acid Ester Sulfate
Wetting and Rewetting Agent	SOROLENE G PASTE	Sodium Alkylnaphthalene-Sulfonate
Wetting Agent	NEUTRONYX 600	Aromatic Polyglycol Ether
Wetting Agent	N S A E PASTE	Sodium Alkylnaphthalenesulfonate
Wetting Agent	ESTRAMINE	Fatty Acid-Alkanolamine Condensate
Wetting Agent	XYNOMINE	Sodium Amide Sulfate

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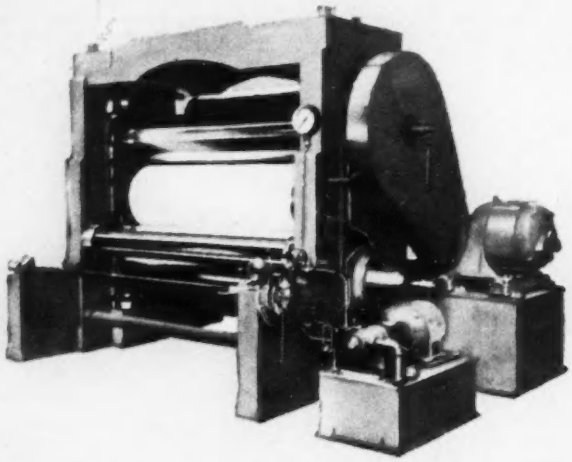
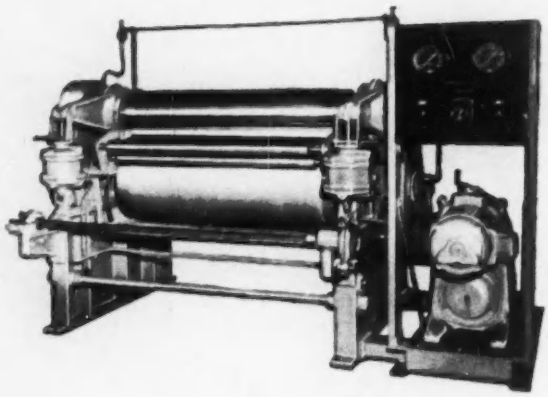
BETTER because you get the highest quality and better production of finished goods on Van Vlaanderen Calenders.

Van Vlaanderen's superiority is based on the correct design of each part to make a smooth operating unit. Take the 80 Ton Hydraulic Calender, for instance. Unit construction eliminates the need for special foundation and anchor bolts. Full 80 ton nip pressure is secured with only 770 pounds of oil pressure. This low pressure is possible because of the exclusive Van Vlaanderen large-area hydraulic ram designed with precision made pistons and four compression rings. Spherical roller bearings enable a 25 h. p. motor to easily drive the machine at 75 y.p.m. 16" top and 20" bottom rolls are made of turned, ground and polished chilled iron, channeled for steam. 22" intermediate roll is of bonded cotton on forged steel shaft.

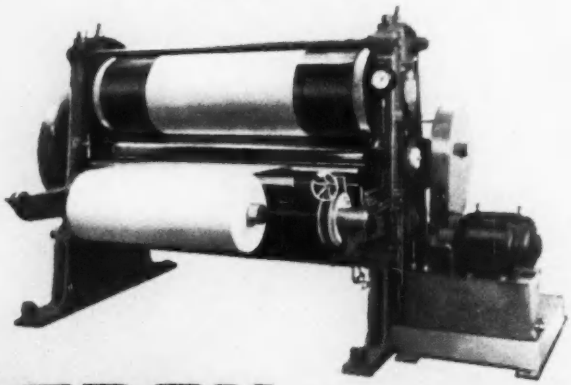
All Van Vlaanderen Calenders have many important quality features. Ask us to send you information on the calender that interests you.



80 TON HYDRAULIC - ALSO MADE IN 40 TONS



20 TON EMBOSSING



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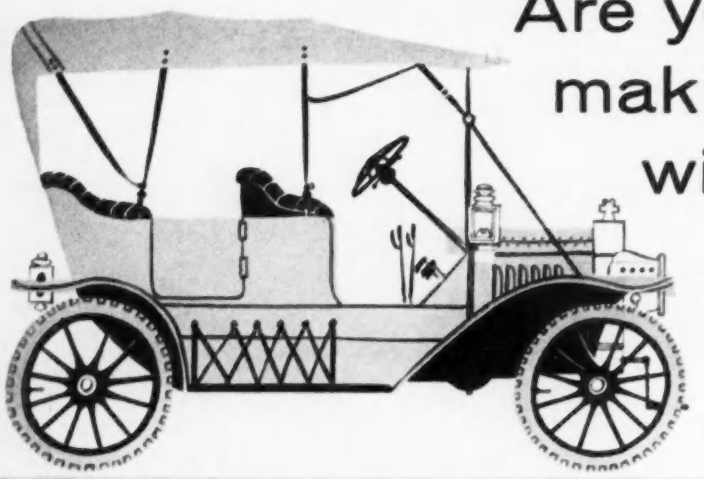

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In a single piece of equipment, The Lixate Process combines a method of dissolving rock salt without agitation and a method of filtration.

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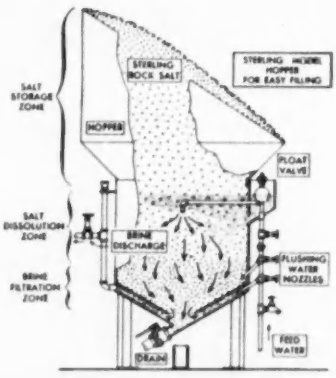
Rock Salt or Evaporated Salt—International provides both in all forms. It provides also any technical advice on salt, brine, or auxiliary equipment, required by users, for either kind of salt.



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CHARACTERISTICS: A clear, amber-colored liquid—a new type of modified amine condensate product with soap-like action on wool.

A versatile detergent . . . a fast rinser . . . consistently gives low residual oil contents with all types of wool oils.

Replaces soap completely in normal fulling and scouring with substantial savings in washer time and hot water. Also, more efficient than soap in removing wool oils.

SUGGESTED USES: Outstanding for "acid" fulling and scouring wool fabrics carbonized in the grease, producing a soap type finish.

Repeatedly, Kyro AC has proven superior in cutting fulling time, eliminating wrinkles, minimizing stretch-out in the washer and dye kettle, and producing fabrics of noticeably better body and cover.

Batch or dolly scouring of fabrics which are not fulled.

Fulling and scouring color sensitive stock-dyed fancy woolens.

Fulling and scouring papermakers' felts.

Ideal for fulling and scouring sweater bodies—cashmere, lamb's wool and blends. Retains the natural softness of cashmere.

Wool yarn scouring.

Package scouring Orlon-Wool Worsted Jersey materials.

Kyro EO

CHARACTERISTICS: A new nonionic of the alkyl phenol polyethylene oxide condensate type. A clear liquid with a pH of about 7.5.

A superior detergent, wetting and re-wetting agent and dye assistant on all types of fibers.

Safe for use with acids, alkalies, salts, oxidizing agents, reducing agents, resins, water repellents and softening or finishing agents—cationic, anionic and nonionic types.

High dispersive action on lime soaps—minimizes odor and discoloration troubles.

SUGGESTED USES:

COTTONS. Wetting out raw stock yarns and piece goods prior to dyeing.
Soaping off raw stock, yarns and piece goods.
Kier boiling yarns and piece goods.
Bleaching package yarns and piece goods.
Removing unfixed surface resins and residual catalyst from piece goods.
Improving ginning of raw stocks.
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An effective detergent for removing oils, starches and sizing materials in the boil-off.
For wetting out prior to dyeing.
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Atco Dyeing & Printing Assistants
Atco Wetting Agents
Atco Anti-Statics
Atco Gas Fading Inhibitors
Atco Slip Proofing Agents, etc.

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Chemicals, Dyes and Intermediates
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Use this efficient—time proven—emulsion combination from your winder emulsion troughs and profit from a new high in quality, luster and softness. HYDROCOP and 3B SOFTENER will help you to obtain increased production of smooth, more even running, more easily knit yarns.

HYDROCOP and **3B SOFTENER** speed up the conditioning of greige, dyed or bleached yarns; cotton; woolen, worsted and cashmere; orlon; nylon; rayon and blends.

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let us send you samples and more information

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NOW! a New Low Cost, Low Calcium Brine!

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● Saves money on sequestering agents! ● Eliminates streaks and off-shading! ● Increases color intensity!

MORTON "PCB" is a new, patented rock salt product. It contains southern rock salt, plus special chemical compounds in pelletized form to give a controlled dissolving rate. The purpose of this combination is to keep harmful calcium deposits from going into solution, and thus eliminate them from the brine.

As the chart below shows, "PCB" Rock Salt brine contains approximately 80% *less calcium* than brine made with untreated rock salt. (The less than 200 PPM calcium in "PCB" brine will not precipitate.) What's more, "PCB" can be used in your present rock salt dissolving equipment without additional construction or extra labor.

"PCB" is specifically recommended when brine is used in dyeing rawstock, package, beam, beck or jig with either sulphur, direct or naphthol dyes. ("PCB" brine also can be used effectively in your water softener.)

ORDINARY ROCK SALT BRINE AVERAGES 800 PPM
PCB ROCK SALT BRINE AVERAGES 200 PPM

PPM Calcium in Brine

Brine made from ordinary rock salt contains approximately 4 times more calcium than brine made with new "PCB".

"PCB" Brine

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FREE! Let a Morton Brine Engineer take a sample of your brine. He'll have it analyzed in Morton's laboratory and tell you how much you can reduce the calcium content by using "PCB" Salt.

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WEST WARREN, MASS.
PHONE WARREN 41

April 2, 1955.

REPLY TO: West Warren, Mass.

Mr. Harry G. Olson,
Textile Sales Manager.
Taylor Instrument Companies
Rochester, New York

Dear Mr. Olson:

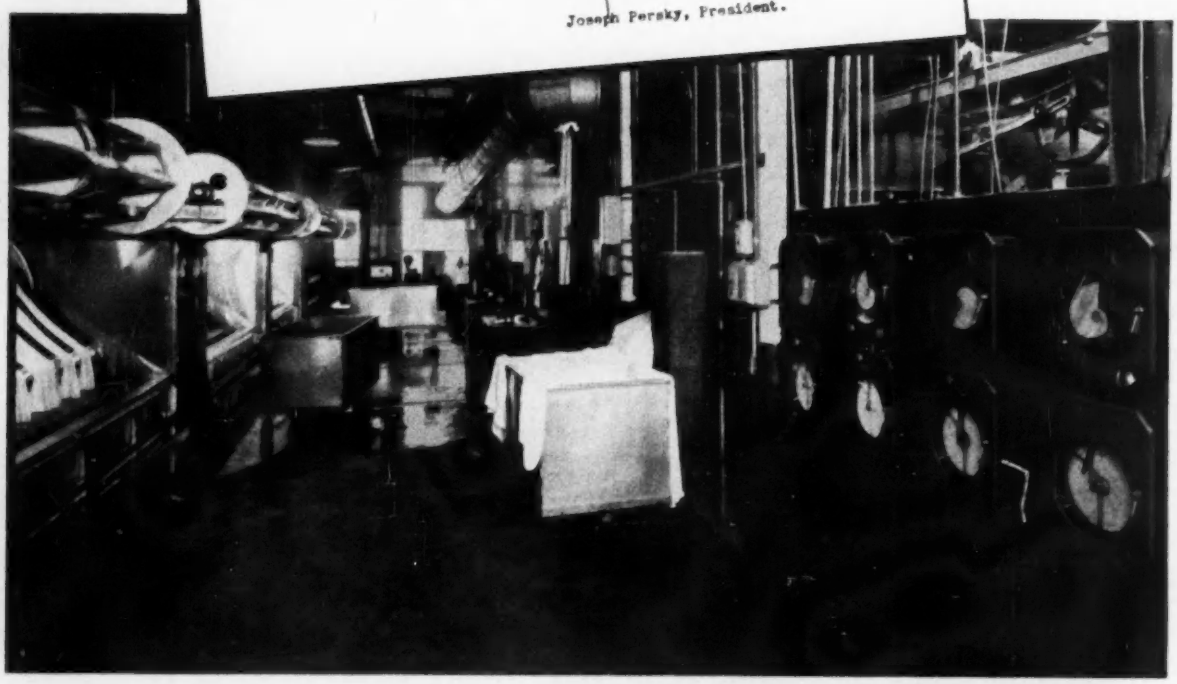
We could not help but write you and express our satisfaction with the operation of your FULFLEX Time Cycle Controllers. We did not really appreciate these instruments until we commenced the knitting and dyeing of synthetics.

Dyeing of synthetics is an extremely difficult operation and there is no question but that without TAYLOR controls we could not otherwise maintain the accurate and precise control which is so necessary in our operations.

You may rest assured that TAYLOR controls will remain a number one necessity to our business in the years ahead.

Very truly yours,

Joseph Persky, President.



THERE are at least 25 different ways in which Taylor controls can help cut costs and maintain quality in the Textile industry. Your Taylor Field Engineer can advise you or, if you prefer, write direct to Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Taylor Instruments
MEAN ACCURACY FIRST

for colors *truly fast* – by *your* standards –

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Whatever the use for the fabrics you dye or print—for clothing, upholstery, draperies, floor coverings, awnings, etc.—the unavoidable demand is that they shall be fast-to-light, fast-to-washing. Your customer's business is safeguarded, when you use vat colors . . . Indanthrene Vat Dyes have been the standard of the industry for more than 50 years.

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- "Supraflx Paste" brands—non-drying, non-freezing, fast-fixing pastes for printing
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- "Paste" and "Dble. Paste" brands—dispersed pastes for dyeing

and now—
- "Infra Paste" brands—finer milled to afford instant and complete dispersion—speck-free in lighter shades—new, trouble-free ease of working

Consider the strategic location of our warehouses and laboratories to meet your immediate needs. Call upon our Technical Service Department for assistance in any color or color-matching problem. We invite your inquiry.

From Research to Reality

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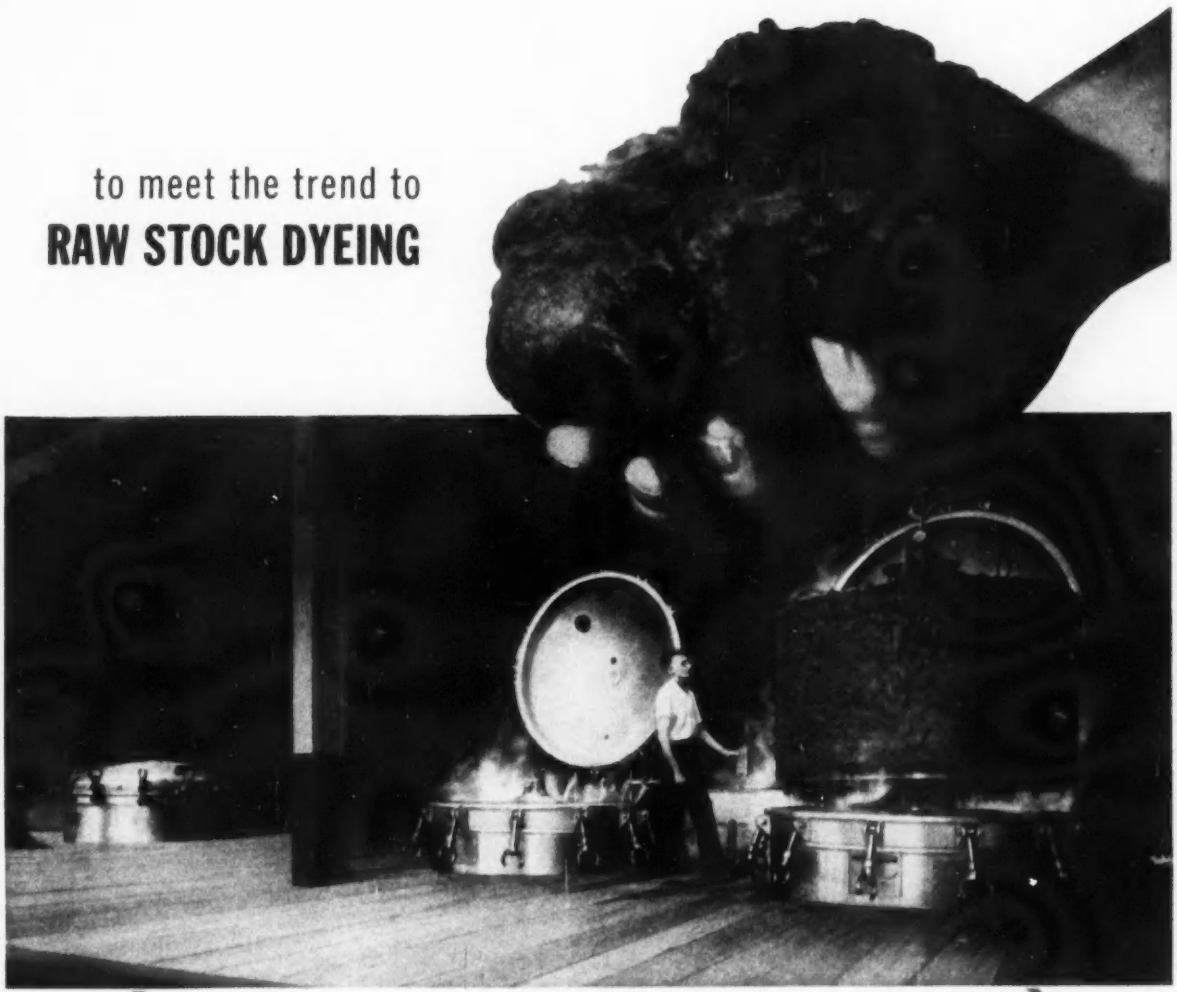
to meet the trend to

RAW STOCK DYEING



The new

SMITH-DRUM

High Temperature

RAW STOCK DYEING MACHINE

There is an increasing trend to raw stock dyeing . . . of both wool and synthetic fibers. To meet this trend, SMITH-DRUM has applied its years of experience in package dyeing to the development of a new Raw Stock Dyeing Machine. This new machine, which has been thoroughly tested in actual operations, embodies many of the exclusive features that have made the SMITH-DRUM Package Dyeing Machine the leader in its field. It is extremely versatile and may be used for high temperature or normal temperature dyeing of both wool and synthetics. It insures more *even dyeing* because it provides uniform distribution of liquor flow. Unloading is easier and faster, due to the carrier design which provides a vertical dividing plate. Tanks are built and tested to A.S.M.E. standards. Complete information will be supplied on request.

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Southern Representatives:
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Also Builders of Dyeing Machines for Packages, Beams, Tops, Rayon Cakes and Skeins.

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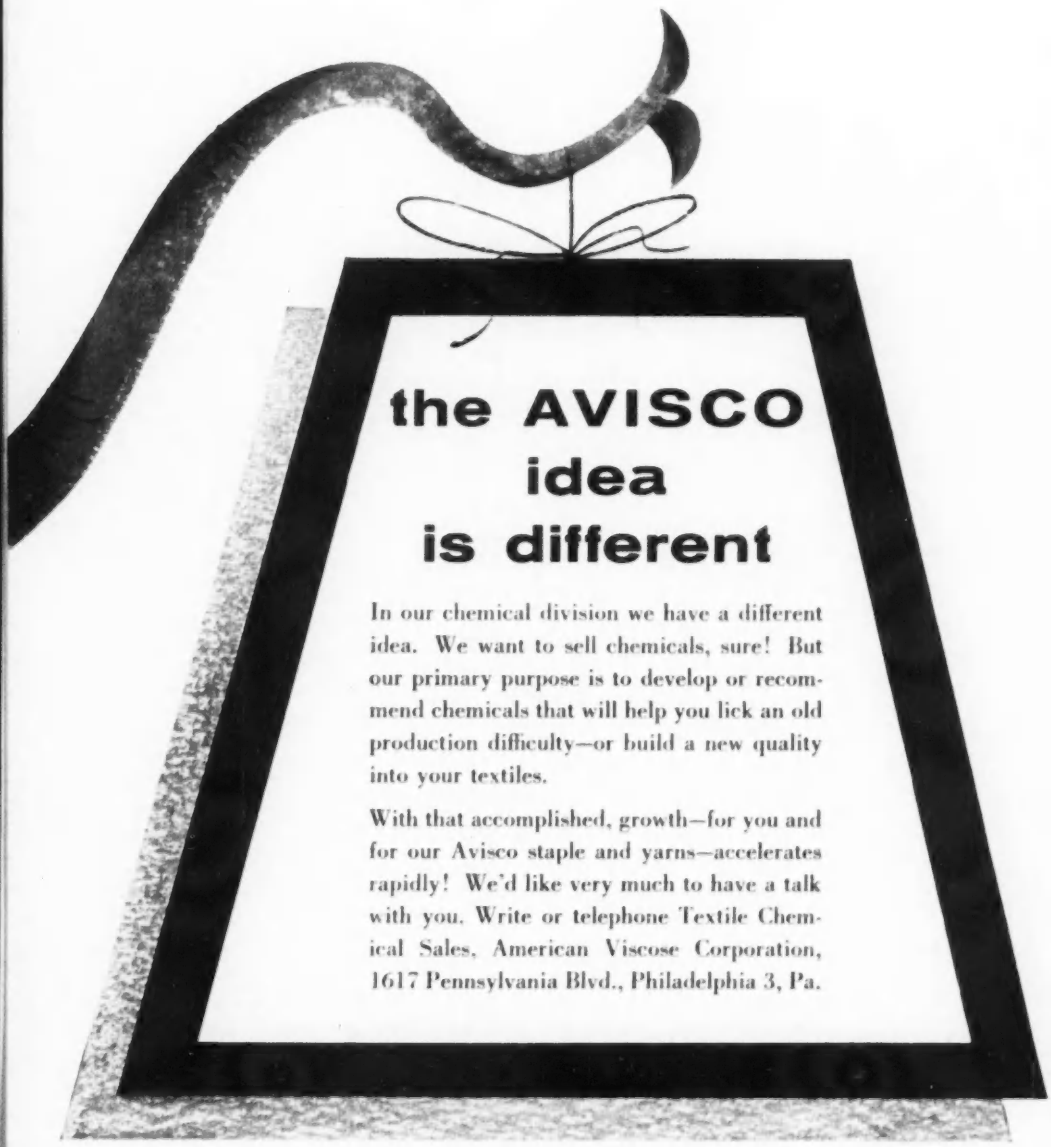
AVISCO*
TEXTILE
CHEMICALS



the AVISCO idea is different

In our chemical division we have a different idea. We want to sell chemicals, sure! But our primary purpose is to develop or recommend chemicals that will help you lick an old production difficulty—or build a new quality into your textiles.

With that accomplished, growth—for you and for our Avisco staple and yarns—accelerates rapidly! We'd like very much to have a talk with you. Write or telephone Textile Chemical Sales, American Viscose Corporation, 1617 Pennsylvania Blvd., Philadelphia 3, Pa.

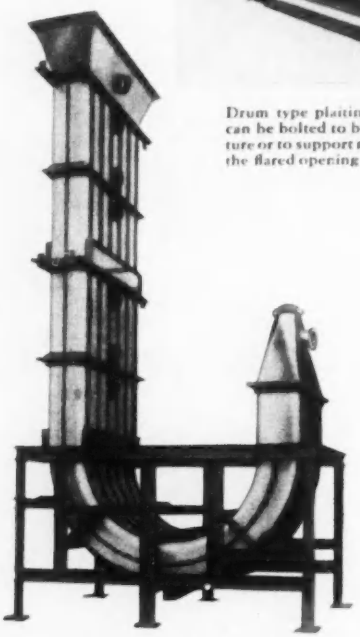
AVISCO
TEXTILE CHEMICALS

Avisco is the trade mark of American Viscose Corporation

WIESNER-RAPP
J-BOXES

Wiesner-Rapp open width J-Boxes for the DuPont process are also available. Design is essentially the same as J-Boxes for roped goods

Drum type plaiting mechanism can be bolted to building structure or to support members over the flared opening of the J-Box



For the DU PONT process

Distinguishing design features of Wiesner-Rapp J-Boxes for the DuPont process are the pre-heat tube and steam manifold, and the enclosed plaiter mechanism. Steam injected into the pre-heat tube heats the cloth as it is introduced into the J-Box. Additional steam supplied in the enclosed plaiter mechanism thoroughly heats the cloth as it is plaited into the J-Box.

For the BECCO process

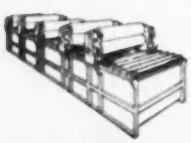
Features of the Wiesner-Rapp J-Box for the Becco process are the open plaiting mechanism, flared J-Box top section, and provisions for flooded operation of the curved bottom section, permitting smooth travel of the cloth through the J. Steam manifolds located at different levels in the high side of the J heat the cloth during and after plaiting.

There is a Wiesner-Rapp J-Box to fit your mill's continuous processing requirements, whether large or small. A wide selection of J-Box capacities is made possible by combinations of standard sections which are available with design features for either the Becco or DuPont process.

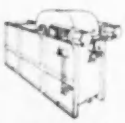
Wiesner-Rapp J-Boxes are known for their high quality construction, having double welded seams, extra heavy curved bottom, steam-tight section joints, generously rounded corners and polished J-Box interior surfaces to facilitate smooth travel of the goods. Pyrex sight glasses are installed at different levels, flush with the inside surface. The delivery end is provided with a quick-action, positive-locking access door .... Our technical staff will be glad to discuss your processing requirements in detail, whether they are for a complete Wiesner-Rapp Bleaching Range or a J-Box to work in harmony with your other equipment.

OTHER WIESNER-RAPP MACHINES

MULTI-STAGE WASHER



OPEN-WIDTH WASHER



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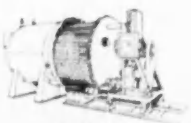

BAROTOR

THE WIESNER-RAPP CO. INC. ★ Buffalo, New York ★

THE WIESNER-RAPP CO., INC.

1620 SENECA ST., BUFFALO 10, N. Y.

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Keep Standards High With Standard Finishes

by JOHN J. BLOETJES

Metropolitan N. Y. Sales Representative

The problem of whites on acetate, nylon, Dacron, Orlon, and all synthetic fibers are solved with the use of Standafin 77, a fully polymerized resin in emulsion form that requires no curing or after-treatment, no washing, and is readily applied by ordinary finishing procedures on conventional equipment. The problems of yellowing of whites and light shades are eliminated; the worry of odor is gone.

Standafin 77 imparts a soft, silky hand, is an exceptionally good non-slip and is compatible with starches, weighters and dullers. The cost of finishing with Standafin 77 is low, as you use small percentages of this resin. In most formulas, 2 to 5% of Standafin 77 has been found to do an exceptional job.

In finishing of Nylon and Dacron for men's shirtings Standafin 77 imparts a full soft hand that gives wonderful quality to these fabrics. This product also has very good anti-static properties. Finishers of Acetate satins that require a high lustre and good non-slip qualities for use in underwear, etc. find that Standafin 77 gives these qualities, as well as the assurance that the product does not irritate the skin or cause dermititis.

Standafin 77 is easy to use as it goes into solution very readily and does not foam. It is dissolved in approximately an equal amount of water at 120° – 140°F. and the solution added to the bulk of the finishing liquor. The goods are padded on a thoroughly cleaned quetsch at 120°F. Curing is unnecessary but drying must be complete with no tackiness resulting from insufficient drying. If padding and drying in two separate operations is necessary, it is well to batch up loosely or run into a box and avoid partial or uneven drying.

Calendering, decatizing, etc. now follow as desired. It has been found that a light calendering, with just the weight of the warm roll as set, tends to fluff up spun rayons by breaking down any surface film, although this may be found unnecessary.

Let STANDARD help you standardize your finishing standards.

Standardgrams

Pyrotex 121, an Economical Wet Processing Agent for All Fabrics

While there are hundreds of detergents on the market today, Pyrotex 121 has been found to answer the dyers' need for a product that is easy to handle, easy to dissolve, and one that can be used on all fabrics.

Having a pH of 7, Pyrotex 121 can be used on acetate, rayon, nylon, Orlon, Dacron and all synthetic fibers. It dissolves easily in water, to form a neutral solution having good stability in hard water.

Low cost operation results from small amounts of Pyrotex 121 needed for boil-off, scouring, penetration, dyeing, print washing, after soaping and naphthol dyeing. Best results are obtained when used with TSPP, tripolyphosphate, etc. Use of Pyrotex 121 reduces the number of rinses because of its easy rinsability.

Pyrotex 121 has exceptional sudsing qualities which are very necessary, particularly in jig dyeing. This promotes a clean bath. In jig scouring and dyeing, one to two pounds of Pyrotex 121 per jig is usually sufficient. In regular stick boil-off or continuous boil-off machines, such as Hermas, Henniken Boil-Off Machines, Morrison or Van Vlaanderen, ⅛ to ¼ % on the weight of the liquor is usually sufficient.

In dyeing, Pyrotex 121 promotes levelness, penetration and clear shades; chafing and rub marks are prevented and the goods are left with a soft, pleasing hand.

We recommend you try Pyrotex 121 – it's truly the "Aristocrat of Detergents."

Standafin T. Conc. Gives Swish to Taffeta

When a taffeta finish requiring swish, non-slip and extraordinary character is needed, send for STANDAFIN T CONC. It imparts a rustling sound, firm hand and fullness that is so desirable in this type of cloth.

STANDAFIN T CONC. is a non-curing resin that requires no curing after-treatment or washing. It can be used with weighters and water repellent compounds.

STANDAFIN T CONC. is easy to use on pad, quetsch, or Palmer tenter unit. It will not mark off and is not affected by atmospheric conditions.

Phone us and switch to STANDAFIN T CONC.

Standafin 92 Uses

For a blanket binding finish that imparts a smooth round hand as well as a good luster, use STANDAFIN 92. This product has uses in the childrens' and ladies' blouse field as well.

Phone or write us for samples and information on this product.

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Butterworth *DURA-SMOOTH* Rolls play a vital part in the finishing end of the textile industry. The right roll for the job . . . the right material . . . the right degree of hardness and smoothness . . . all contribute to economical finishing and uniform quality control.

For example, in a Butterworth Water Mangle, pressures up to 15 tons require Butterworth *DURA-SMOOTH* special rolls, designed for heavy-duty service and long, trouble-free operation.

In a Butterworth Embossing Calender, Butterworth *DURA-SMOOTH* Rolls provide uniform embossing characteristics, with no variation from lot to lot. That's because all Butterworth Rolls are quality-controlled at every step in manufacture.

And in a Butterworth Calender, pressures are accurately adjusted to each side of the roll, for even pressures across the face. Butterworth *DURA-SMOOTH* Rolls never loosen or slip . . . they're locked on a forged steel shaft under controlled pressure.

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3
ALKALIS

18
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53
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With Westvaco as a supplier you will be sure of prompt delivery from our ample, expanding facilities. Our wide choice of packaging . . . from a bag to a barge . . . minimizes your inventory and warehousing problems . . . saves you time and money.

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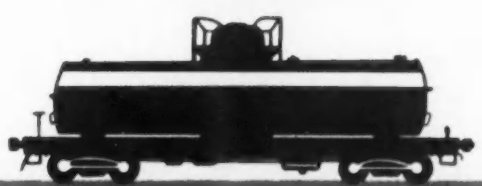

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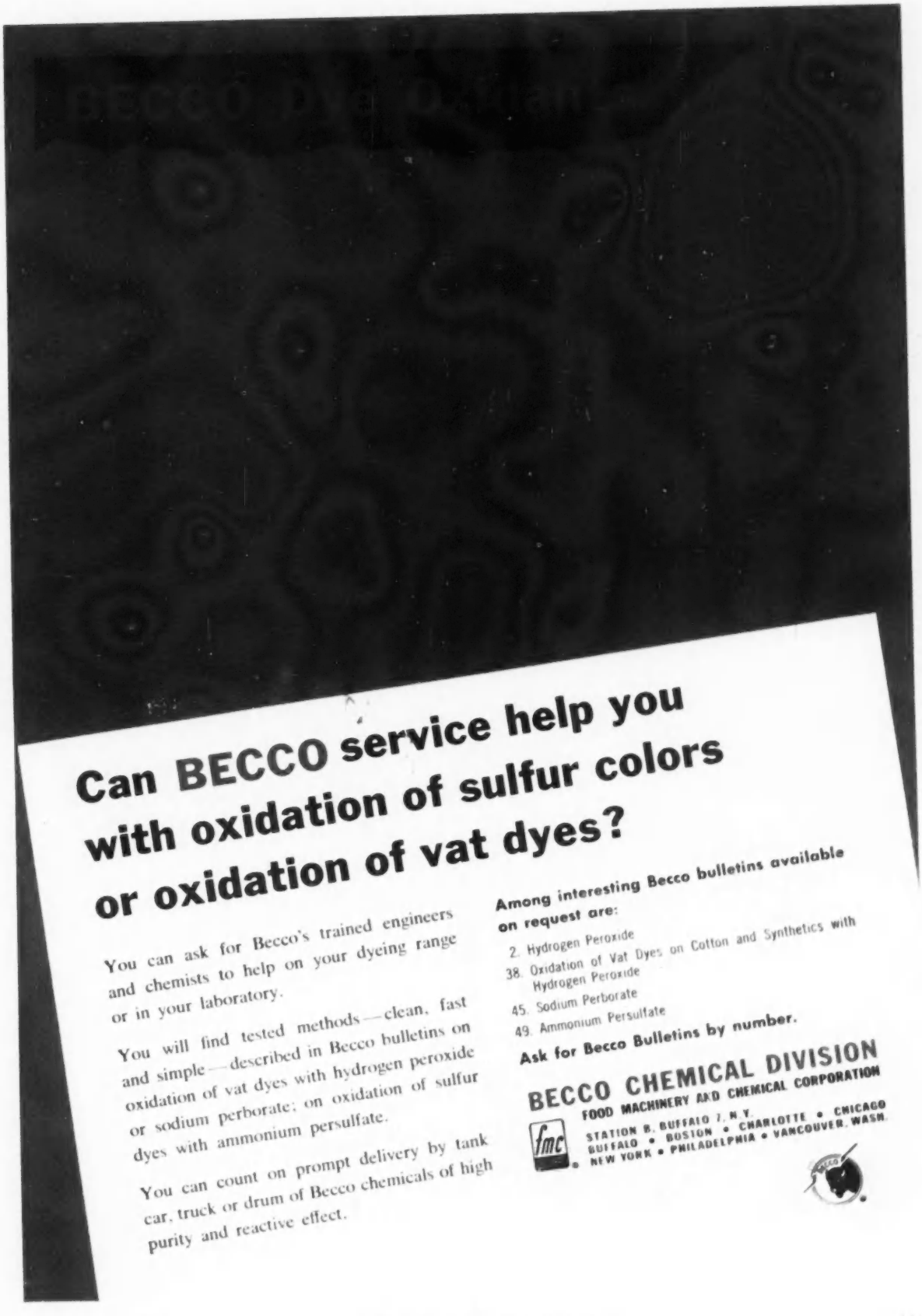

Can BECCO service help you with oxidation of sulfur colors or oxidation of vat dyes?

You can ask for Becco's trained engineers and chemists to help on your dyeing range or in your laboratory.

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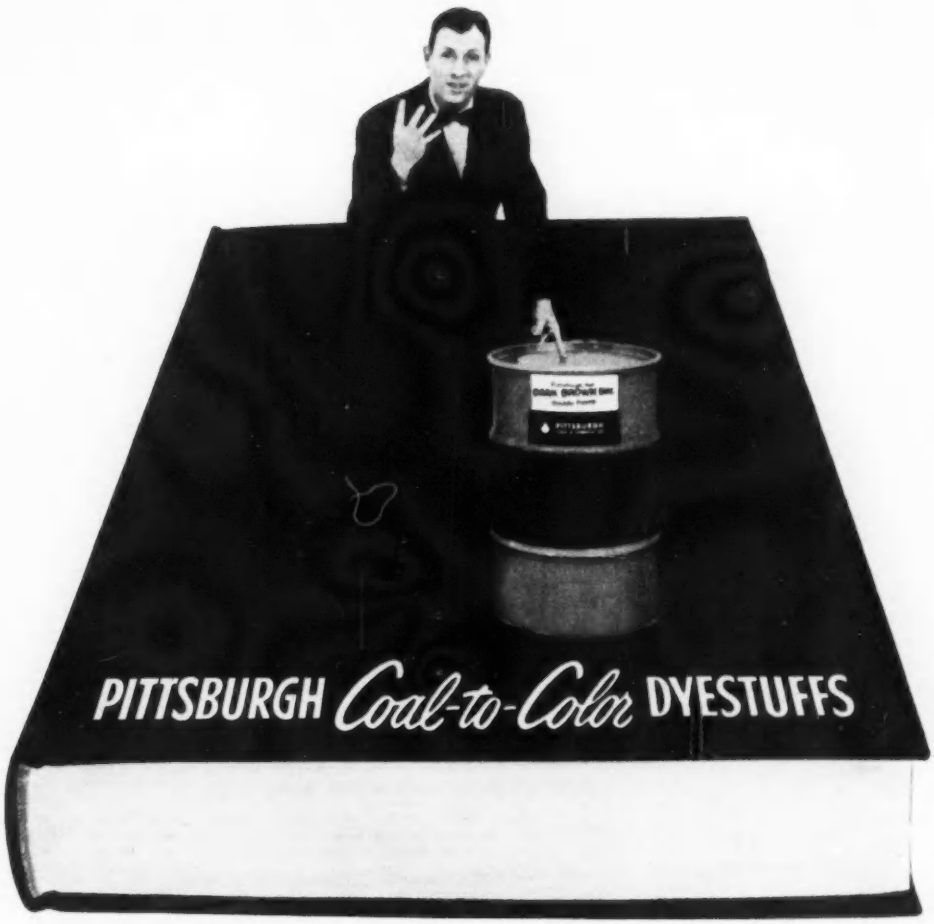

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1. Colors of uniform high purity and fastness—because Pittsburgh painstakingly controls quality in its completely integrated plant.

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We invite you to phone our Spartanburg sales office any time of the day or night . . . on holidays or weekends! You'll find us on the job and ready to help you.

You'll *like* doing business with Pittsburgh . . . for it means quality products and alert service. Call us about your vat dye requirements *today!*

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* Pharmol Bordeaux BN

Rich, economical bordeaux shades of good fastness to light washing and chlorine

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Devoted to Textile Chemistry
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Proceedings of the

American Association of Textile Chemists and Colorists

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Editor of Proceedings: Carl Z Draves, 30 Lahey St, New Hyde Park, N Y

NOVEMBER 7, 1955

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Student Chapters

BRADFORD DURFEE TECHNICAL INSTITUTE, CLEMSON COLLEGE, FAIRLEIGH DICKINSON COLLEGE, GEORGIA INSTITUTE OF TECHNOLOGY, LOWELL TECHNOLOGICAL INSTITUTE, NEW BEDFORD INSTITUTE OF TEXTILES AND TECHNOLOGY, NORTH CAROLINA STATE COLLEGE, PHILADELPHIA TEXTILE INSTITUTE, RHODE ISLAND SCHOOL OF DESIGN, UTICA TECHNICAL INSTITUTE

AATCC Newsgram

November 7, 1955

RESEARCH NEWS IN GENERAL

Members of the Technical Committee on Research have voted approval of: (1) Proposed modification and standardization of the six-fiber test cloths used with various AATCC test procedures and (2) Raising Tentative Test Method 24-52 (Resistance of Textiles to Insects and Micro-Organisms) to status of a Standard Test Method. . . .Committee on Rapid Control Testing has instituted a laboratory investigation to determine advisability of presenting a rapid control test for evaluating dimensional stability of textiles. The method will employ 6" x 6" specimens and the washing procedure will be carried out in the Launder-Ometer, using steel tubes. . . . Study of the relative action of soap and detergents, with and without optical bleach, on various dyed fabrics, is underway at the request of the Washfastness Committee. Investigation of the cumulative effect of several consecutive cycles of laundering will be made. . . . TCR held open meetings at the recent Convention in Atlantic City, with a number of subcommittees reporting progress to date. Following regular TCR business, Dr Stiegler, Charles Dorn and Jim Fynn presented details of the set-ups, preparation and evaluation connected with the atomic explosion exposure last Spring. AATCC also erected an impressive display of the mannequins and fabric frames used in the shot, at the annual Dyeing and Finishing Exhibition, held in conjunction with the Convention. . . . It has been announced that just before the next Convention (during the Perkin Centennial celebration in New York) ISO will hold a group of meetings—on Sept 6, 7 and 8 (and possibly the 10th).

AT RESEARCH HEADQUARTERS

Continued interest of foreign groups in the AATCC research effort was highlighted recently by the visit of a delegation of six textile mill engineers from Mexico, who were conducted through AATCC laboratories. Their questions indicated a keen and growing interest in American production technology. The delegation included: Moises Mustri, of Textiles Eugenia; Edwardo Aguilera, of Sedas Aguila; Fausto Gutierrez, of Textiles Morelos; Hector Gonzalez and Roberto Lerch, of Sedas Parisina; and Ricardo M Ferre-d'Amare, also of Sedas Aguila. . . . Another recent foreign visitor was Robert Blondel, president of the Rouen Textile Industry Research Center, in Rouen, France, who is currently visiting the U S, making a study of the relationship between industry and education. M Blondel was taken through the AATCC labs during his visit to Lowell Technological Institute.

Other visitors recently: Elmer Rossin, Scott Foster, Charles Williams and John Stewart, of the Monsanto Chemical Co, who spent some time with Dr Stiegler and Harlen Glidden discussing abrasion testing in general and the use of the Accelerotor in particular. They reported they have carried on extensive investigation of the Accelerotor in recent years, and were in need of additional information to help them attain better reproduceability. This information was readily supplied. . . . E J Krumlauf, of the Owens Corning Fiberglas Co, another recent visitor, reported his Company has been using the Accelerotor for about a year in testing glass fabrics and finds it to be of considerable value.

COMMITTEE NEWS

Leonard Little, ECR Chairman, reported recently the formation of several new committees: Committee on Pilling; Committee on Soiling; and Committee on Resistance of Textiles to Weathering, of which Frank Rizzo is chairman. Mr Little has asked all chairmen to check their committee's test procedures to be sure all details of the operations are covered, to help insure uniform results.

AATCC Monograph No. 2

"THE APPLICATION OF VAT DYES"

$5.00, postpaid, to members

$6.00, postpaid, to nonmembers

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H C CHAPIN, SECRETARY, AATCC • P O BOX 28 • LOWELL, MASS

AATCC CALENDAR

COUNCIL
Nov 18, Jan 20 (Hotel Statler, New York, N Y); April 20; June 15; Sept, 1956; Nov 16, 1956; Jan 18, 1957.

NATIONAL CONVENTIONS
Sept 13-15, 1956 (Waldorf-Astoria, New York); 1957 (Boston); 1958 (Chicago); 1959 (Washington, DC).

HUDSON-MOHAWK SECTION
Nov 18 (Hotel Johnstown, Johnstown, N Y); Jan 20 (Jack's Restaurant, Albany, NY); March 16 (Hotel Johnstown, Johnstown, N Y); May 18 (Ladies Nite); June 22 (Annual Outing).

NEW YORK SECTION
Nov 18 (Kohler's Swiss Chalet, Rochelle Park, N J); Jan 27, Feb 24 (Hotel Delmonico, New York, N Y); Mar 23, Apr 27, May 18 (Kohler's Swiss Chalet, Rochelle Park, N J).

NIAGARA FRONTIER SECTION
Dec 2, Jan 20 (U S); Mar 3 (Canada—meeting to be held in conjunction with Ontario Section, CATCC); Apr 27 (U S).

NORTHERN NEW ENGLAND SECTION
Dec 9.

PACIFIC SOUTHWEST SECTION
Feb 6 (Gourmet Restaurant, Beverly Hills, Calif).

PHILADELPHIA SECTION
Dec 2, Jan 13 (Kugler's Restaurant).

PIEDMONT SECTION
Oct 29 (Hotel Wm R Barringer, Charlotte, N C).

RHODE ISLAND SECTION
Dec 1 (Johnson's Grille, Providence, R I).

SOUTH CENTRAL SECTION
Dec 10 (Hotel Patten, Chattanooga, Tenn).

SOUTHEASTERN SECTION
Dec 3 (Atlanta Biltmore, Atlanta, Ga).

WESTERN NEW ENGLAND SECTION
Dec 16 (Rapp's Restaurant, Sheldon, Conn).

Back numbers of American Dyestuff Reporter less than two years old may be obtained from Howes Publishing Co, Inc, 44 East 23rd Street, New York 10, N Y, and earlier numbers from the Secretary, American Association of Textile Chemists and Colorists, P O Box 28, Lowell, Massachusetts.

Prices postpaid: 50 cents each to nonmembers of AATCC, 35 cents to members; complete volumes $5.25 to nonmembers, $4.50 to members.

Membership Applications

October 19, 1955

SENIOR

Tally D Fulmer—Chemical dir, Cotton Fin Div, Pacific Mills, Lyman, S C. Section: Pied. Sponsors: H C Woodruff, S G Stribling III.

John A Leddy—Supt of Dyeing & Fin, Burlington Mills Corp, Greensboro, N C. Section: Pied. Sponsors: R W Powel, B P Swanson.

Samuel M Rankin—Dir of sales, Southern States, Treplow Prod, Inc, Paterson, N J. Section: NY. Sponsors: F Fortess, A Wolpert.

Hubert Y Simerson—Chemist & tech demonstrator, E I du Pont de Nemours & Co, Inc. Section: NY. Sponsors: C Mentzer, K Ferguson.

Samuel Sterman—Research chemist, Linde Air Products Co, Tonawanda, N Y. Section: NF. Sponsors: V G Paul, R J Fortune.

Leo J Stuckens—Tech dir, American Photocopy Equipment Co, Chicago, Ill. Section: MW. Sponsors: W D Paine, E W Hazekamp.

Ralph D Ward—Master dyer, Aberfoyle Mfg Co, Belmont, N C. Section: Pied. Sponsors: E T Mobley, A R Thompson.

JUNIOR

Paul C Blackstone—Chemical engineer, Cranston Print Works Co, Cranston, R I. Section: RI. Sponsors: E W Lawrence, R H Phillips.

Robert G Eddy—Fabric development, E I du Pont de Nemours & Co, Inc, Wilmington, Del. Section: Phil. Sponsors: D H Haigh, E F Valko.

Louise F Harrington—Chemist, Cranston Print Works Co, Cranston, R I. Section: RI. Sponsors: E W Lawrence, R H Phillips.

M *Geraldine Hemming*—Lab tech, National Inst of Drycleaning, Silver Spring, Md. Section: W. Sponsors: R T Graham, G P Fulton.

ASSOCIATE

Louis Bay, 2nd—Vice pres, sales, Dixon Chemical & Research Co, Clifton, N J. Section: NY.

John Ewing—Sec, treas, gen mgr, Robert Ewing & Sons, Inc, Green Island, N Y. Section: HM.

Richard A Feis—Tech dir, Cone Mills, Inc, New York, N Y. Section: NY.

Saburo Hayase—Salesman, Nichimen Co, Inc, New York, N Y. Section: NY.

Walter N Rand—Salesman, American Aniline Products, Inc, Hawthorne, N J. Section: NY.

APPLICATION FOR TRANSFER TO SENIOR MEMBERSHIP

Donald R Christie
Walter J Kennedy
Achilles Mathios

STUDENT

Thomas C Cox—Philadelphia Textile Institute. Sponsor: W H Hughes.

Robert E Houce—Rhode Island School of Design. Sponsor: H B Sturtevant.

Normand E Veys—St Hyacinthe Textile School. Sponsor: G R Boule.

CORPORATE

Conover Knitting Co
Dorr Woolen Co
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Rodney Hunt Machine Co
Stein Hall & Co, Inc
Virginia-Carolina Chemical Corp

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

55-30

Education: BS, textile chemistry
Experience: textile chemist
Age: 30; married; veteran; references; position in technical sales & service desired, northeastern U S.

10-24, 11-7

NOTICE

To Authors and Section Officials

Under a new ruling of the Publications Committee, all papers presented before local sections of AATCC must be submitted direct to the publishers of the AMERICAN DYESTUFF REPORTER, 44 East 23rd St, New York 10, N Y. Two copies of each manuscript should be submitted in accordance with the "Notice to Authors", which appears periodically in the Proceedings of AATCC.

ACTIVITIES OF THE LOCAL SECTIONS

NEW YORK———At the October 14th meeting of the New York Section a paper entitled "The Eastofix Colors" by James M Straley and Duncan G Carmichael of Tennessee Eastman Co was presented by Dr Straley. In the absence of the chairman, John H Hennessey, who was ill, the treasurer, John A Komninos, presided. Mr Komninos referred to the coming national election and introduced Henry L Young, candidate for vice president for the Central Atlantic Region. The attendance was 150.

* * * * * *

PACIFIC NORTHWEST———A regular meeting of the Pacific Northwest Section was held on October 14, 1955, following dinner in the Mezzanine Room of the Benson Hotel, Portland, Oregon.

Speakers of the evening were Joseph H Jones, Phoenix Dye Works, AATCC vice president (Western Region), and B R Koenig of the Section's Technical Committee. Mr Jones discussed the various objectives and future plans of the Association, and Mr Koenig spoke briefly on the possibilities of a cooperative research effort for the Section.

Attendance: 30.

* * * * * *

PACIFIC SOUTHWEST SECTION———Forty members and guests attended the regular quarterly meeting of the Pacific Southwest Section held October 7, 1955 at the Gourmet Restaurant, Beverly Hills, Calif.

Joseph H Jones, Phoenix Dye Works, AATCC vice president (Western Region), discussed many aspects of the Association's work, including research, publications, corporate membership, the Perkin Centennial, the *Colour Index*, AATCC participation in the '55 A-bomb tests, the newly formed Subject and Speakers Bureau, etc. A question-and-answer period followed.

Edwin Lindquist, Geigy Chemical Corp, reported on the Section's Outing, which was held the weekend of Sept 24 at Rancho Sante Fe with 77 members and guests attending.

The following were named to serve as a Nominating Committe: T B Smock, Jr, Joseph De La Barre, and Mr Lindquist.

The Section will hold a dinner dance on December 2nd at the Clock Country Club in South Whittier, Calif.

The next regular meeting is scheduled for February 6th at the Gourmet Restaurant.

* * * * * *

RHODE ISLAND———The Fall meeting of the Rhode Island Section was held on Thursday, October 13, 1955 at Johnson's Grill, Providence, R I, with approximately 185 members and guests in attendance.

Maurice R Fox, Imperial Chemical Industries, Ltd and Arnold, Hoffman & Co, Inc, delivered a paper on "Practical Interpretations of the Results of Laboratory Investigations in the Field of Vat Printing," which was supplemented with colored slides.

Present at the meeting was AATCC president Raymond W Jacoby, who discussed the success of the recent Atlantic City convention. He also discussed the most recent meeting of the Council, and praised the efforts of the Section's Intersectional Contest Committee, which prepared the first-prize winning paper in this year's Contest.

The paper, which appears in this issue of the *Proceedings*, will be presented before the Section at its annual meeting on December 1 at Johnson's Grill. Alberic T DiMasi, chairman of the Committee, will deliver the paper and also give a short resume of how a paper is prepared and what transpires from the time the subject matter is decided up to the eventual editing and printing of the finished product.

A slate of officers for 1956 will be presented and voted upon at the Dec 1st meeting.

AUDITOR'S REPORT

TO the Members of the
American Association of Textile Chemists and Colorists:

We have made an examination of the accompanying statement and supporting schedule summarizing the cash receipts and disbursements of the treasurer and secretary of the American Association of Textile Chemists and Colorists for the year ended July 31, 1955. In connection therewith, we examined or tested the cashbooks and other records supporting the receipts and disbursements by methods and to the extent we deemed appropriate, but we did not communicate with the members to confirm the amount of recorded receipts from dues and subscriptions or from advance subscriptions for the *Colour Index*.

In our opinion, the accompanying statement and supporting schedule fairly summarize the recorded cash receipts and disbursements (excluding receipts and disbursements on sales and purchases of investment securities) of the Association for the year ended July 31, 1955 and the balances of cash in banks, advance expense funds, and securities owned as of that date.

PRICE WATERHOUSE & CO.

75 Federal Street
Boston 10, Mass.
September 12, 1955

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

SCHEDULE OF MISCELLANEOUS INCOME
FOR THE YEAR ENDED JULY 31, 1955

Research:		
Launder-Ometer royalties	$ 175.00	
Grey scales	129.50	
Accelerotor liners	315.00	
Research Committee Symposium	1,852.57	$ 2,472.07
Sales of technical supplies, royalties, etc.:		
Year Books	$2,977.34	
Dye standards	194.00	
Knitted tubing	175.20	
Dyestuff Reporters and reprints	474.42	
Crock-meter cloth	603.44	
Crock meters	3,632.64	
Moth cloth	210.63	
Multi-fibre cloth royalties	1,882.12	
Flammability tester royalties	687.00	
Water-test apparatus	464.22	
Gas-fading units	165.00	
Color transference charts	1,131.78	
Analytical Methods Monograph #1	257.61	
Buttons, etc.	27.75	
Application of Vat Dyes Monograph #2	1,379.03	
Cotton skeins commissions	104.80	
Standard grease wool	214.50	
Accelerotor royalties	283.10	14,864.58
Total miscellaneous income		$17,336.65

TREASURER'S REPORT

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

STATEMENT SUMMARIZING CASH RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDED JULY 31, 1955
(excluding receipts and disbursements on sales and purchases of investment securities)

			Allocation of funds							
			Special Research Projects							
	Total	*General Research*	*Philadelphia Section Research Project*	*Colour Index—Second Edition (See Footnote)* *Receipts*	*Colour Index—Second Edition (See Footnote)* *Disbursements*	*American Dyestuff Reporter Prize Award Fund*	*Olney Medal Fund*	*Convention Fund*	*Technical Supplies*	*General*
Receipts:										
Membership dues:										
Corporate memberships	$ 49,920.00	$ 46,830.00								$ 3,090.00
Sustaining memberships	587.50	587.50								
Senior Junior, Associate and Student Memberships	66,624.50									66,624.50
Total membership dues	$117,132.00	$ 47,417.50								$ 69,714.50
American Dyestuff Reporter—Prize Award Fund	1,001.10					$1,001.10				
Annual meeting registrations—net amount received from Southeastern Section	17,056.67							$17,056.67		
Dividends and interest received (net)	11,221.71	3,945.13		$ 614.07		235.76	$ 476.90			5,949.85
Advance subscriptions to Colour Index	409.00			$ 409.00						
Miscellaneous income, per accompanying schedule	17,336.65	2,472.07							$14,864.58	
Total receipts	$164,157.13	$ 53,834.70		$ 1,023.07		$1,236.86	$ 476.90	$17,056.67	$14,864.58	$ 75,664.35
Disbursements:										
Research salaries and expenses	$ 53,944.28	$ 53,944.28								
Howes Publishing Company—Subscriptions to American Dyestuff Reporter	20,071.69								$ 2,044.57	$ 18,027.12
Disbursements for account of Olney Medal Fund	118.84						$ 118.84			
Allowances to Southern sections for 1954 Convention and other convention expenses	3,581.62							$ 3,581.62		
Secretary's expenses, clerical assistance, etc	34,549.23								4,155.70	30,393.53
American Dyestuff Reporter Prize Award	200.00					$ 200.00				
Publicity	1,492.56	1,322.07								170.49
Purchases of technical supplies for resale	3,197.67								3,197.67	
Section membership allowances	3,737.89									3,737.89
Other general expenses	1,071.80									1,071.80
Total disbursements	$121,965.58	$ 55,266.35				$ 200.00	$ 118.84	$ 3,581.62	$ 9,397.94	$ 53,400.83
Excess (deficiency) of receipts over disbursements	$ 42,191.55	($ 1,431.65)		$ 1,023.07		$1,036.86	$ 358.06	$13,475.05	$ 5,466.64	$ 22,263.52
Cash in banks, advance expense funds and investments (at cost), July 31, 1954	313,611.84	116,298.90	$2,000.00	20,289.89	($41,693.05)	7,198.90	6,760.68	20,608.56	17,721.55	164,426.41
Cash in banks, advance expense funds and investments (at cost), July 31, 1955	$355,803.39	$114,867.25	$2,000.00	$21,312.96	($41,693.05)	$8,235.76	$7,118.74	$34,083.61	$23,188.19	$186,689.93

Summary of cash in banks, advance expense funds and investments at July 31, 1955:		
Cash in banks		$136,558.93
Advance expense funds		5,500.00
United States Government obligations, at cost		
Savings Bonds (value at maturity $37,000; redemption value at July 31, 1955 $32,164)	$32,800.00	
Treasury Bonds, etc. (face amount $70,000; value based on market quotations July 31, 1955 $69,250)	69,803.78	102,603.78
Other marketable securities, at cost (value based on market quotations July 31, 1955 $209,651)		111,140.68
		$355,803.39

Note: Under the agreement dated January 18, 1952, between the Association and The Society of Dyers and Colourists of Bradford, England, all costs incurred in connection with the compilation, printing, distributing, etc of the "Colour Index (Second Edition)" are to be borne equally by the parties thereto. Future net losses or revenues arising from the production and sale of this work are likewise to be borne or shared equally by the parties. The Association's total commitment under the agreement, representing half the presently estimated cost of production, is approximately $126,000. The Association and the British Society, each in their respective territories, are receiving subscriptions in advance of publication to assist in financing the project. As at July 31, 1955, the Association on its part had expended for salaries and other costs a total amount of $41,693.05 and had received $21,312.96, including $20,400.83 for advance subscriptions and $912.08 for interest on savings bank deposits. The British Society has reported that, as of December 31, 1954, it had expended £14,801 for costs and expenses and had received £14,664 for advance subscriptions and £248 for interest on bank deposits. The joint agreement requires annual equalization settlements between the parties with respect to costs paid and revenues received by each. Because of British exchange restrictions, the annual equalization settlements through December 31, 1954 have been waived by mutual agreement.

Respectfully submitted:
ALBERT E. SAMPSON
Treasurer
American Association of Textile Chemists and Colorists

NOTICE TO AUTHORS OF PAPERS

MANUSCRIPTS for the *Proceedings* and for other publications of the American Association of Textile Chemists and Colorists shall conform to the requirements and standards given in this *Notice*. Before publication, manuscripts for the *Proceedings* shall be approved by the Editor, not only for editorial correctness according to the standards of this *Notice*, but also for content of technical matter. In his work, the Editor may enlist the aid of anonymous reviewers who are selected for expert knowledge in particular fields.

It is presumed that authors in studying the comments of reviewers and of the Editor will remember that all recommendations are made in a kindly, helpful, sympathetic manner to improve the paper in both literary and technical excellence. Although authors should cheerfully consider suggestions, they are expected to defend their position if justified, especially when strictly technical matters are involved with which the authors have an intimate knowledge.

MANUSCRIPTS—Manuscripts shall be typewritten double-spaced with approximately one-inch margins on 8.5 x 11-inch white paper. In addition to the *original*, at least one carbon copy is required. Pages are to be numbered consecutively with Arabic numerals, and each page after the first shall carry the authorship at the very top. Tables and figures shall also be numbered consecutively, the tables with headings containing Roman numerals as TABLE I, TABLE II, etc, and the figures with Arabic numerals as Figure 1, Figure 2, etc, appearing *below* the figures. The names of the authors and their laboratories or business connections should appear below the title of the paper.

ARTICLES APPEARING IN THE "PROCEEDINGS" IN RECENT ISSUES OF THE "AMERICAN DYESTUFF REPORTER" will be helpful to authors as models of form for the typing of manuscripts.

LITERARY STYLE AND FORM OF PRESENTATION—In the writing of papers, authors are requested to observe a trenchant, simple style of writing directed to textile chemists and colorists with at least an elementary knowledge of chemistry, physics, mathematics, engineering, textile processes and textile machinery.

In the organization of the material, there should be one or more introductory paragraphs setting forth the occasion, significance and main objectives of the paper and of the method of attack. This should be followed by the body of the presentation, either with discussions interspersed throughout this portion or with a collected section marked "DISCUSSION" after the main body of the paper. Finally, there may be a brief section at the end entitled "SUMMARY" of "CONCLUSIONS."

Center and side headings make for easier reading. Center headings should be employed sparingly and generally will include only very important section headings, such as "INTRODUCTION," "EXPERIMENTAL," "DISCUSSION," "CONCLUSIONS," "SUMMARY," and "REFERENCES." Side headings (see third paragraph of this *Notice* for an example) shall be indented and run into the text to which they apply, and shall be separated from the paragrpah by a dash. The publisher will print center headings in bold-face capitals and side headings in capitals.

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Photographs of authors should be included with copy, to be run in conjunction with the paper. These must be on glossy stock, and should be large enough for proper reproduction.

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1955 Intersectional Contest—— First-Prize Winner

THE EFFECT OF MERCERIZATION ON THE PROPERTIES OF A CREASE-RESISTANT COTTON FABRIC*

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In preparing cotton fabrics for crease-resistant finishing, it is common practice to include a mercerization treatment prior to resin impregnation. To what extent this premercerization treatment actually affects the results apparently has not been thoroughly investigated, judging by the paucity of information on the subject in the published literature.

The object of this project was to study the effect of varying degrees of mercerization on the crush resistance and other related properties of a typical cotton fabric (80 x 80) when resinated. The cloth was bleached by two different methods: continuous-peroxide, and kier-boil followed by chemic. Portions of both bleaches were mercerized with six different strengths of caustic soda and also double-mercerized with two strengths. Two different crease-resisting finishes were applied; a urea-formaldehyde paste resin, and a methylated melamine syrup resin. All of the processing operations were carried out on a plant scale.

Specimens taken from the fabric at various stages of processing were tested against the unresinated goods for crease resistance, abrasion resistance, tensile and tear strength. The degree of mercerization of the various specimens was also determined by the Barium method, fluidity tests, dyeing tests, and spectrophotometric charts.

The results of the various trials are classified and summarized.

INTRODUCTION

IN THE preparation of cotton fabrics for crease-resistant finishes, commercial practice usually includes a mercerizing treatment prior to the application of resin *(1, 2, 3)*. With regard to the value of this premercerization treatment, the published literature on the subject is somewhat contradictory. Fischer *(4)* reported, "It was found that thorough fabric preparation to produce absorbent goods and mercerization were most important in helping to maintain tensile strength and tear-strength properties." Smith *(5)* reported, "Fibers such as cotton or linen have a high proportion of crystalline regions and are lowered in tensile strength by amino-resin treatment, any increase in tensile strength in the amorphous regions being outweighed by the greater decrease in strength in the crystalline regions. This average decrease in tensile strength is reduced by processes such as mercerization which increase the percentage of amorphous material. . . ." On the other hand, the Philadelphia Section Intersectional Contest Committee *(6)*, in reporting on resin treatment, stated, "Premercerization (of cotton) has relatively slight effect"; and "Textile Chemist" *(7)* reported, "Mercerization (of cotton) has not proved useful."

A search of the literature failed to disclose any adequate experimental evidence in support of these conflicting statements.

The purpose of this project was to compile experimental data to determine the value of premercerization on resinated cotton goods, and, in particular, to find the answers to the following questions:—

1) What effect, if any, does premercerization have on the wrinkle recovery of resinated cotton?

2) What effect does premercerization have on tear and tensile strength and abrasion resistance of resinated cotton?

3) What are the optimum conditions for conducting such premercerization?

It was decided at the outset to confine the project to one particular fabric, a typical 80 x 80 cotton print cloth. Since the preparation of the fabric has an important influence on the final results, one half of the cloth was bleached by the continuous peroxide method, and the other half by kier-chemic. Portions of both

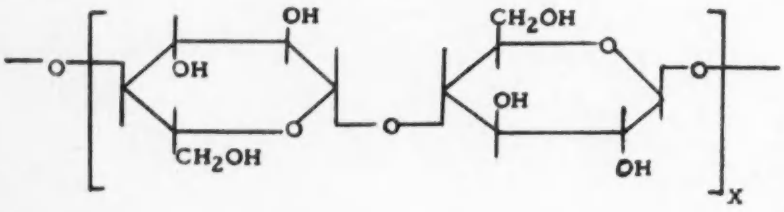
* Presented by W George Parks in the Viking Room, Haddon Hall, Atlantic City, N J on Saturday, Sept 24, 1955.

prepares were mercerized with six different concentrations of caustic soda, and also double mercerized with two concentrations. Unmercerized portions were retained for comparison. Two different resins were employed for the anticrease process: a urea-formaldehyde paste and a methylated methylol-melamine syrup. All operations were performed on plant equipment, using a total of 5,000 yards of 80 x 80 cotton cloth. Finally, the various portions of the fabric so treated were tested for crease resistance, abrasion resistance, tear and tensile strength, dimensional stability, resin pickup, percentage of fixed resin, distribution of resin in the fiber, and hand. The degree of mercerization was determined by Barium number and by dye-absorption tests.

Full details of these various operations are presented in the following sections.

CHEMISTRY OF MERCERIZATION

The effect of mercerization on cotton has been studied extensively *(8, 17)*. Chemically, cotton is nearly pure cellulose, which is composed of polymeric molecules of about one thousand repeating units of cellobiose with the following formula:



X-ray photographs of cotton fibers have shown that these long molecules are arranged as a network of more or less parallel chains, with bundles of parallel chains forming crystalline micelles, which are surrounded by amorphous regions *(27)*.

Treatment of cotton with strong sodium hydroxide solution has been shown to result in structural changes, such as swelling, deconvolution, shrinkage, and change in cross-sectional shape. On swelling, the flat, ribbon-like hairs become oval or circular in cross section and become untwisted so that smooth cylindrical rods are formed *(11)*. An appreciable amount of shrinkage results during mercerization unless the original length of the fiber is maintained by tension or restored by stretching after shrinkage *(12)*. This contraction in length is believed to be due to a decrease in the orientation of crystallites, which occurs when tension is not applied. The greater orientation resulting from mercerization under tension affords a more nearly circular fiber cross-section, which results in a maximum luster *(13)*. The increase in tensile strength, which is characteristic of mercerization under tension, has been correlated with crystallite orientation *(14)* and is the result of the increased intermolecular forces between parallel molecules.

Internally, the swelling results in a separation of the molecular chains and an accompanying rearrangement that affords an increased reactivity as evidenced by greater absorptivity and enhanced dyestuff affinity *(15)*. This change is believed attributable to an increase in the available hydroxyl groups on the cellulose chains *(16)*. While the amorphous regions of native cotton may possess two accessible hydroxyl groups per glucose unit, the crystalline portions are believed to contain no free hydroxyl groups. On treatment with sodium hydroxide solution, surfaces of the crystalline regions are transformed into semicrystalline regions that have one free hydroxyl group per glucose unit. Thus, mercerization results in a change in the cellulose lattice, which renders more hydroxyl groups accessible. The resulting increase in water and dyestuff absorptivities is greatest in the case of mercerization without tension.

Considerable research has been done and numerous theories have been advanced to explain the mechanism of the swelling action of sodium hydroxide on cotton fibers *(9)*. X-ray evidence provided the final proof that the sodium hydroxide forms an actual compound with the hydroxyl groups of the cellulose *(18)*. The modern theory of swelling is due principally to the work of Neale *(19)*. Following the formation of a sodium salt by the very weakly acidic cellulose, excess alkali is believed to diffuse into the fiber according to Donnan's equation of membrane equilibrium. The resulting unequal distribution of ionic charges causes osmotic pressure, which forces water into the fiber and causes swelling.

Mercerization is influenced by the concentration of sodium hydroxide solution used and the temperature of treatment. Studies on the effect of varying concentrations of sodium hydroxide on mercerization efficiency have indicated good agreement on the basis of barium hydroxide absorption *(20)*, luster, fiber strength, dyeing power and X-ray measurements *(21)*. Mercerization at room temperature commences at concentrations above 20-25°Tw (8.8-11%) and increases to a maximum at a concentration of about 40°Tw (18%) above which no appreciable effect is observed by increasing the concentration to 85°Tw (39%). Shrinkage during mercerization, unlike other properties of the fiber, decreases with increasing concentration of alkali above a maximum at about 45°Tw (20%). Due to the preferential adsorption of sodium hydroxide by the fiber, it is customary in practice to employ concentrations of alkali of between 45 and 65°Tw (20 to 29%) in order to compensate for that adsorbed by the cotton.

An increase in the temperature of mercerization has been shown to decrease the amount of sodium hydroxide absorbed and consequently the extent of the mercerization. On the basis of X-ray measurements, Sisson *(22)* determined the concentration of alkali required for complete mercerization at varying temperatures. For an increase from 10 to 30°C an increase in concentration from 29 to 36°Tw (13 to 16%) was required. Mercerization at room temperature is considered most satisfactory.

CHEMISTRY OF RESIN APPLICATION TO CELLULOSE

This discussion will be limited to a consideration of aminoplasts, ie, the urea-formaldehyde and melamine-formaldehyde types, which are most commonly employed on cotton textiles for the improvement of crease-resistance, dye fastness, and dimensional stability. To achieve these advantages there must be an internal deposition and subsequent polymerization of the resin within the fibers. There must not be an appreciable deposition between the separate fibers, and the resin should be discontinuous.

The results obtained from internal resin application depend mostly on the manner and position in which the resin is deposited throughout the cellulose. It has already been stated that the cellulose fiber has areas of both amorphous and crystalline structure. The internal deposition of resin precondensate favors the amorphous areas *(5)*. Pretreatment of cellulosic materials is undertaken largely to increase the proportion of amorphous cellulose and to swell the fibers, thereby improving their absorbency for the resinous materials. Foulds, Marsh and Wood *(3)* recommend "treating the individual fibers with a swelling agent," and state. . . . "It is preferable to mercerize the fabric before impregnation (with resin), and the mercerization must be well done."

Precondensation products of the appropriate resin types and of low molecular weight must be employed to penetrate the fibers properly. A high-molecular-weight precondensate resin will not go into the fiber, but rather will coat between and over the fibers, causing a stiffening effect and lowering wrinkle recovery of the fabric.

There are two theories of the mechanics of resin formation within the cellulose fiber. In the early TBL patents it was claimed that the urea-formaldehyde or melamine-formaldehyde monomer penetrates the cellulose fiber structure and under the influence of heat becomes condensed or polymerized to form an insoluble resin *in situ*. On the other hand, Cameron and Morton *(23)*, as well as Gagliardi and Gruntfest *(24)* consider that the precondensed monomeric resin reacts not only with itself but also with the hydroxyl groups in the cellulose molecule. This hypothesis is also supported to some extent by Cooke *(25)*.

In practice, the precondensed resin is padded onto the fabric with the addition of an acid-liberating salt as catalyst. Ammonium salts of strong acids are employed for this purpose, eg, ammonium dihydrogen phosphate and ammonium chloride, and more recently, organic amine salts. The latter have increased in popularity as acid-liberating catalysts. The pad expression is usually for a 60-70 percent take-up. The fabric is then dried over a tenter frame, using minimum tension, and avoiding too high a temperature, which would cause migration of the resin to the surface. The cloth is then cured at a higher temperature, eg, 350°F for 70 seconds. This transforms the methylol urea or methylol melamine into its corresponding high-polymer resin form. The fabric is then customarily washed with a dilute soap-soda ash or synthetic detergent-soda ash solution to remove any surface resin and odor-developing compounds, and to produce a more pleasing hand.

PREPARATORY TREATMENTS

The fabric used in the experimental work was a commercially available 80 x 80 print cloth, with the following average physical properties:

Grey width	—	38¼ in
Weight	—	4.10 yds/lb
Tensile:		
warp	—	57.40 lbs/sq in
filling	—	45.30 lbs/sq in
Yarn number:		
warp		Single 26s
filling		Single 38s
Twist:		
warp	—	17 turns/in
filling	—	20 turns/in
Elmendorf tear:		
warp	—	1184 g
filling	—	742 g

In mill practice, the kier-chemic bleach and continuous peroxide bleach are both regularly used in the preparation of cotton cloth; therefore both methods of preparation were included. Details of these procedures are as follows:

PROCEDURE FOR KIER-CHEMIC BLEACH

1) Singe

2) Pad with 0.1% enzyme at 145°F. Hold 45 minutes.

3) Rinse with cold water through tight-strand rope washer.

4) Kier boil 12 hours with solution of
1.00% caustic soda
0.05% tetrasodium pyrophosphate
0.04% alkylarylsulfonate

5) Rinse in kier with warm water; rinse with cold water through tight-strand rope washer.

6) Saturate with 1.7 gpl available chlorine, hold in cold J box 20 minutes.

7) Rinse with cold water through tight-strand rope washer.

8) Saturate with 0.1% sulfuric acid, hold in cold J box 15 minutes.

9) Rinse with cold water through two tight-strand rope washers.

10) Frame-dry.

PROCEDURE FOR CONTINUOUS PEROXIDE BLEACH

1) Singe.

2) Pad with 2.5% enzyme at 160°F, hold in J box for 35 minutes, increasing temperature from 160 to 200°F.

3) Rinse in rope washer with hot water on one side, cold water on one side.

4) Saturate with 1% sulfuric acid, hold cold in J box for 30 minutes.

5) Rinse cold in rope washer.

6) Saturate with 3% caustic soda at 130°F, hold in steam-heated J Box for 90 minutes.

7) Rinse through two rope washers, hot water in first, cold water in second.

8) Saturate with 0.75% hydrogen peroxide and 0.75% sodium silicate (based on weight of goods), hold in steam-heated J box for 90 minutes.

9) Rinse through two rope washers, hot water in first, cold water in second.

10) Can-dry.

The normal concentrations of caustic employed in mercerizing are from 45 to 65°Tw. Selection of the caustic concentrations used for these trials was made to cover this range in increments of 10°Tw and to cover caustic concentrations lower and higher than those normally used. Cloth prepared by both methods was mercerized dry at the same time, using the following concentrations of caustic soda:

TABLE I

RESIN CONTENT AND SOAPING LOSS

	Concentration of mercerizing liquor (°Tw)	*Total resin* (%)	*Soluble resin* (%)	*Nitrogen (Kjeldahl)* (%)
	PEROXIDE PREPARE			
M-F Resin	0	6.85	17.5	3.13
	25	6.71	17.5	2.64
	35	6.74	18.4	2.72
	45	6.66	16.5	2.66
	55	6.76	20.2	2.69
	65	6.74	19.1	2.71
	75	6.54	17.0	2.72
	2 x 45	6.78	16.6	2.63
	2 x 75	6.75	15.8	2.48
U-F Resin	0	11.95	12.4	3.18
	25	11.85	13.7	3.14
	35	11.45	13.5	3.17
	45	11.80	13.6	3.19
	55	11.68	12.2	3.09
	65	11.18	11.5	3.04
	75	11.69	10.6	3.00
	2 x 45	11.50	15.5	3.08
	2 x 75	11.41	16.3	3.03
	KIER CHEMIC PREPARE			
M-F Resin	0	6.39	12.4	2.73
	25	6.71	16.6	2.98
	35	6.85	16.3	2.90
	45	6.69	13.6	2.98
	55	6.65	13.0	3.00
	65	6.48	11.1	3.02
	75	6.15	19.1	2.99
	2 x 45	6.32	17.4	3.03
	2 x 75	6.41	19.9	3.02
U-F Resin	0	12.27	10.9	2.97
	25	11.60	10.5	2.98
	35	11.32	9.7	3.04
	45	11.20	11.3	2.98
	55	10.70	11.5	3.02
	65	10.88	11.3	3.02
	75	10.88	11.8	3.08
	2 x 45	10.47	11.6	2.95
	2 x 75	10.97	12.0	3.08

1) Control—no mercerizing
2) 25°Tw—11%
3) 35°Tw—15%
4) 45°Tw—20%
5) 55°Tw—25%
6) 65°Tw—29%
7) 75°Tw—34%
8) Double mercerized 45°Tw
9) Double mercerized 75°Tw

All the mercerization was done on a conventional chain-type mercerizer at room temperature.

PROCEDURE

1) Double dip, squeeze, single dip, squeeze.

2) Clip frame set to 38½ inches in the first section, the balance of the frame at 38 inches.

3) Open-width wash.

4) Rope wash, rope sour through 0.2% sulfuric acid, double wash, scutch open, mangle, and dry.

5) Steam frame to 35½ inches for resin finishing.

RESIN APPLICATION

The resins were applied on conventional equipment which is normally available in a finishing plant. The procedures used were as follows:

1) Pad (single dip) on a two-bowl mangle with a top rubber roll of medium softness and a stainless-steel bottom roll.

2) Frame-dry at 36½ inches at 240°F. Speed: 30 ypm.

3) Cure in a roller-type gas-fired unit at 350°F for 70 sec.

4) Wash in a 3-section open-width soaper, using sodium perborate, sodium tetraphosphate and a nonionic surface-active agent at 140°F in the first section; water at 120°F in the second section; and water at 80°F in the third section.

5) Frame-dry at 36 inches at 240°F.

Two sets of resinating trials were made. The first set included cloth, prepared by both methods, unmercerized and mercerized at 25°, 35°, 45°, 55°, 65° and 75°Tw, also double mercerized at 45° and 75°Tw.

Urea-Formaldehyde

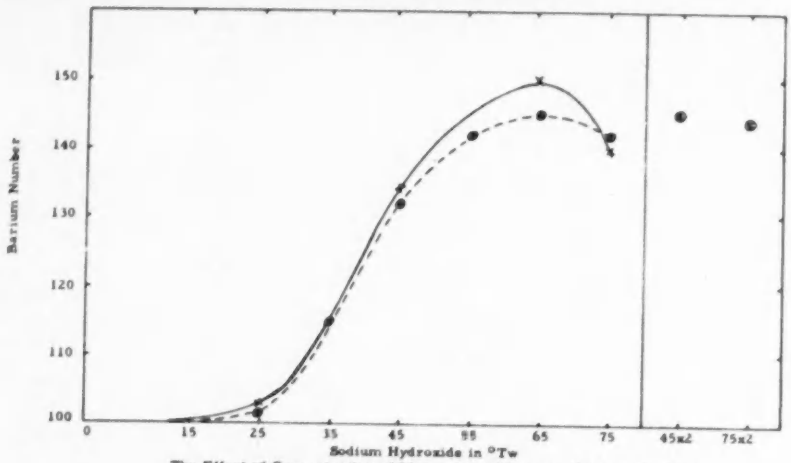
30% urea-formaldehyde resin (50% paste)
1.4% amine hydrochloride catalyst

Melamine-Formaldehyde

16.8% methylated methylol melamine resin (80% syrup)
1.0% amine hydrochloride catalyst

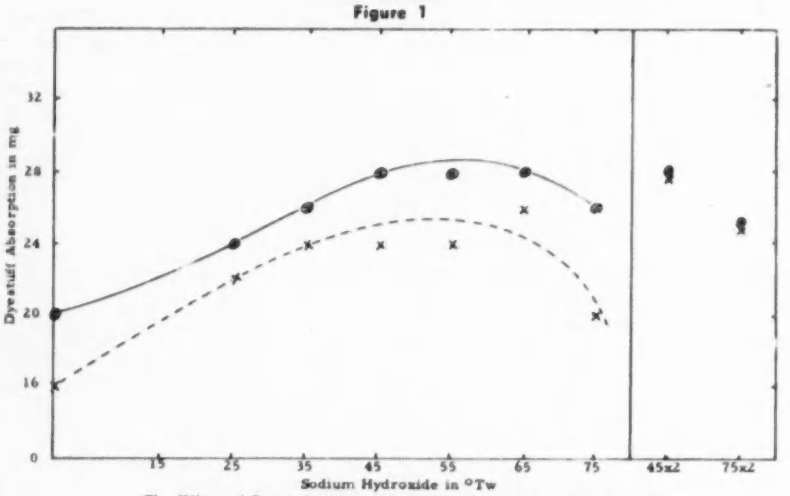
Portions of all samples from this first group were also padded, after washing and drying, with 1.0% stearic-borax softener at 160°F and frame-dried at 36½ inches at 240°F, to determine the effect of aftertreatment with softener.

After evaluation of the data from the first group of samples it was felt advisable to decrease the amount of urea-formaldehyde to improve physical properties and also to determine if any differences could be noted with the various degrees of mercerization at lower resin content.



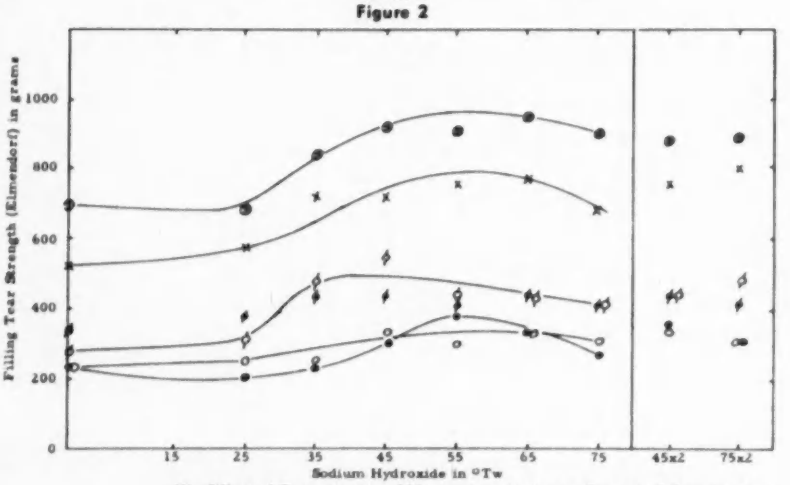
The Effect of Concentration of Mercerizing Liquor on Barium Number. x: Peroxide prepare, no resin; ●: Kier-Chemic prepare, no resin.

Figure 1



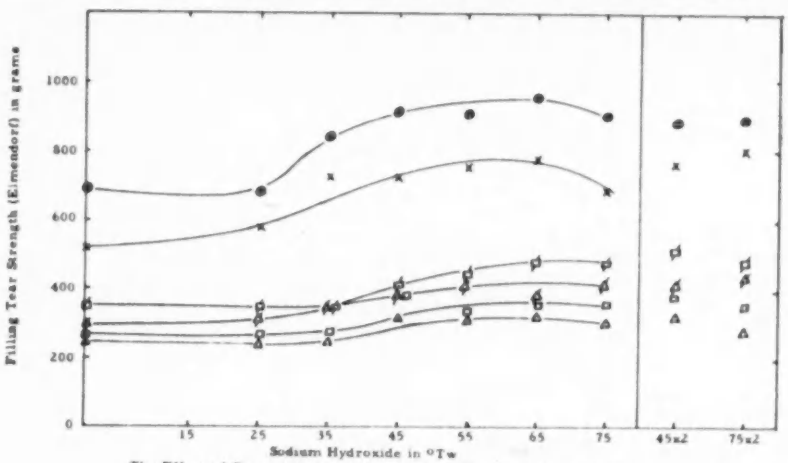
The Effect of Concentration of Mercerizing Liquor on Dyestuff Absorption. x: Peroxide prepare, no resin; ●: Kier-Chemic prepare, no resin.

Figure 2



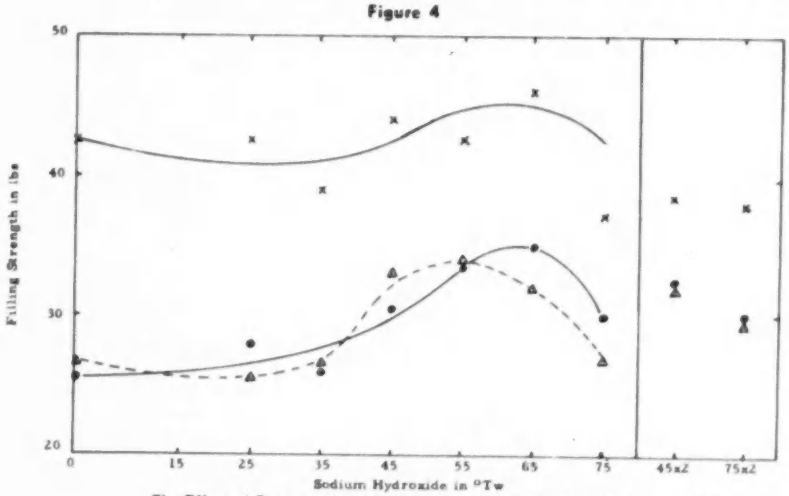
The Effect of Concentration of Mercerizing Liquor on Elmendorf Tear Strength of Filling. Peroxide Prepare: x, no resin; •, U-F resin; ϕ, U-F resin, top-softened. Kier-Chemic Prepare: ●, no resin; ○, U-F resin; ϕ, U-F resin, top-softened.

Figure 3



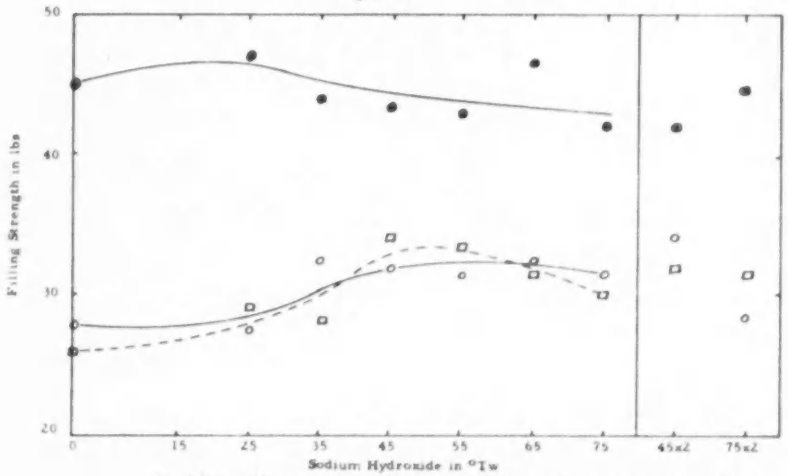
The Effect of Concentration of Mercerizing Liquor on Elmendorf Tear Strength of Filling. Peroxide Prepare: x, no resin; △, M-F resin; ⧄, M-F resin, top-softened. Kier-Chemic Prepare: ●, no resin; □, M-F resin; ◪, M-F resin, top-softened.

Figure 4



The Effect of Concentration of Mercerizing Liquor on Tensile Strength of Filling. Peroxide Prepare: x, no resin; ●, U-F resin; △, M-F resin.

Figure 5



The Effect of Concentration of Mercerizing Liquor on Tensile Strength of Filling. Kier-Chemic Prepare: ●, no resin; ○, U-F resin; □, M-F resin.

Figure 6

A second set of trials was made, using a) a decreased amount of urea-formaldehyde resin with and without the addition of softener, and b) the same concentration of melamine-formaldehyde resin as in the first set, with and without the addition of softener.

In the first set of trials it was noted that optimum results were obtained with samples mercerized from 45° to 65°Tw. Therefore, in the second set, the samples included cloth from both prepares unmercerized and mercerized at 35 and 55°Tw and twice at 45°Tw. These selections were made to limit the number of trials and to include only an unmercerized control, a sample mercerized below the optimum caustic concentration, a sample mercerized at the optimum caustic concentration, and a sample mercerized twice at the low limits of the optimum caustic concentration.

The following formulas were used in the second set of trials:

Urea-Formaldehyde

24% urea-formaldehyde resin (50% paste)
1.1% amine hydrochloride catalyst

Urea-Formaldehyde plus Softener

24% urea-formaldehyde resin (50% paste)
1.1% amine hydrochloride catalyst
0.75% tetra-alkyl ammonium halide softener

Melamine-Formaldehyde

16.8% methylated methylol melamine resin (80% syrup)
1.0% amine hydrochloride catalyst

Melamine-Formaldehyde plus Softener

16.8% methylated methylol melamine resin (80% syrup)
1.0% amine hydrochloride catalyst
0.75% tetra-alkyl ammonium halide softener

TEST METHODS

The various samples, treated as described in a previous section, and representing two different methods of preparation, seven different strengths of mercerizing liquor and two different resin treatments, were tested in the following ways:

1) *For efficiency of mercerization*: determination of Barium activity number (28) (see Fig 1).

2) *For dye absorption*: spectrophotometric measurements of exhausted dyebaths (see Fig 2), and dyeing tests (10).

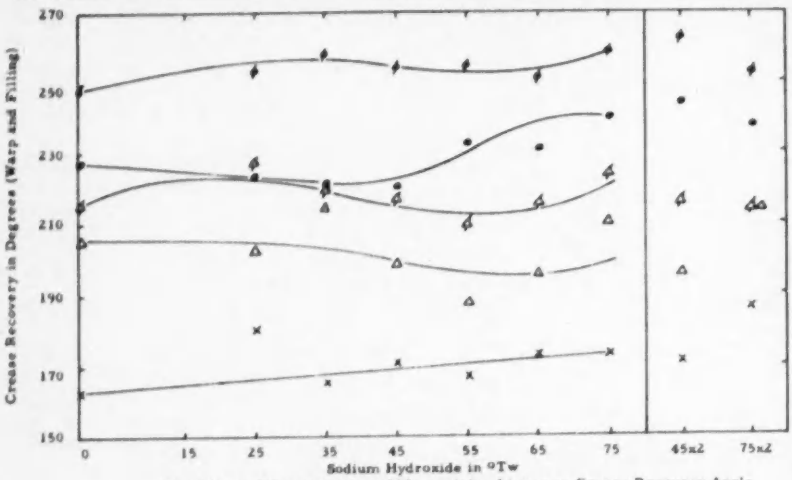
3) *For tear strength*: Elmendorf Tearing Tester (34) (see Figs 3 and 4).

4) *For tensile strength*: Grab Method (ASTM Designation D39-49) (30) (see Figs 5 and 6).

5) *For crease recovery*: Monsanto Wrinkle-Recovery Tester (AATCC Test Method 67-53) (32) (see Figs 7 and 8).

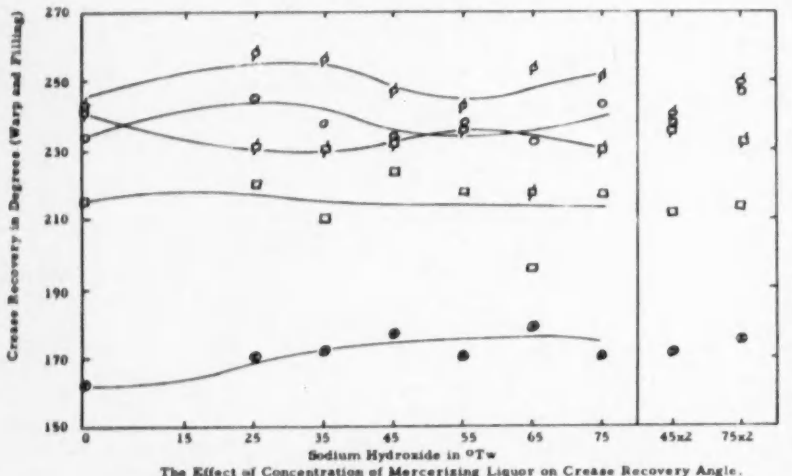
6) *For resistance to abrasion*: Stoll Abrasion Tester (ASTM Designation D1175-51T) (11) (see Figs 9 and 10).

7) *For shrinkage in laundering*: AATCC Test Method 14-53 (33).



The Effect of Concentration of Mercerizing Liquor on Crease Recovery Angle. Peroxide Prepare: x, no resin; ●, U-F resin; △, M-F resin; ϕ, U-F resin, top-softened; ϕ, M-F resin, top-softened.

Figure 7



The Effect of Concentration of Mercerizing Liquor on Crease Recovery Angle. Kier-Chemic Prepare: ●, no resin; o, U-F resin; □, M-F resin; ϕ, U-F resin, top-softened; ϕ, M-F resin, top-softened.

Figure 8

8) *For resin content*: by acid-extraction method (29) and by nitrogen determination (Kjeldahl method) (see Table I).

9) By means of cross-sectional photomicrographs (see paragraph on "Cross-sectional Photomicrographs" under Section entitled "Experimental Data," which follows).

EXPERIMENTAL DATA

DYE ABSORPTION———Comparative dyestuff absorptions were determined by measuring spectrophotometrically the amount of dye remaining in the dyebath after equal weights of fabric were dyed under identical conditions.

Dyeing tests were also made on samples taken from the unresinated fabric, representing all degrees of mercerization. Two different dyes, Trisulfon Brown B (*CI* 561) and Diamine Sky Blue FF (*CI* 518) were applied as follows:

0.2% dye (on volume of bath)
No addition of salt
Ratio of fabric to liquor, 1:200
15 minutes at boil.

All samples were dyed in the same dyebath.

SHRINKAGE IN LAUNDERING———The dimensional stability to laundering of resinated and unresinated fabric was determined according to the standard AATCC procedure. The samples were subjected to one and ten washings. The warp shrinkage on unmercerized unresinated fabric was 4.5% for one wash and 6.5% for ten washes. On mercerized unresinated fabric, the warp shrinkage was 2.5% for one wash and 4% for 10 washes. On resinated fabric, both mercerized and unmercerized, the warp shrinkage was 1% after one wash and 2.25% after ten washes.

DEGREE OF CURING———The degree of curing was checked by a dyeing method based on the principle that the presence of resin on the fiber inhibits the absorption of a direct dye (Diamine Fast Blue FFB, Pr 71) in proportion to the efficiency of the curing operation.

CROSS-SECTIONAL PHOTOMICROGRAPHS (26)———Cross sections across the filling of the fabric, taken from 36 samples of the resin-treated fabrics, were stained with Alizarine Blue SAPG (*CI* 1054) and examined microscopically. Photomicrographs were made at a magnification of 250x, and prints were enlarged to 500x. Penetration of the resin into both the fiber and the fabric was studied.

DISCUSSION OF RESULTS

The results of the tests described on the preceding pages and plotted on Figs 1 to 10 may be summarized as follows.

EFFICIENCY OF MERCERIZATION———The Barium activity number (Fig 1) showed a sharp rise from 25°Tw sodium hydroxide, reaching a peak of 145 (which is considered optimum mercerization) at about 65°Tw, and then declining to 140 at 75°Tw. Double mercerization gave a value of 145, which was no higher than a single treatment at 65°Tw. There was no marked difference in Barium number between the kier-chemic and peroxide prepares.

DYESTUFF ABSORPTION——— As shown in Fig 2, the dyestuff absorption increases with increasing strength of mercerizing liquor until a maximum is reached at 45-65°Tw. Higher caustic concentration results in a decrease in dye absorption.

The dyeing tests made on unmercerized and mercerized fabric showed a steady increase in depth of shade as the concentration of the mercerizing liquor was increased, reaching a peak at approximately 55°Tw. At 65 and 75°Tw the depth decreased progressively. Double mercerization at 45 and 75°Tw gave results equal to single mercerization at these concentrations.

TEAR STRENGTH (Figs 3 and 4)———On the unresinated samples, increasing the caustic soda concentration to 45°Tw resulted in increased Elmendorf tear strength (ie, from approximately

550 g unmercerized to 900 g mercerized). Between 45 and 65°Tw the tear strength remained practically constant, with a slight drop at 75°Tw. Double mercerization at 45 and 75°Tw gave tear strength equivalent to single mercerization at the same concentrations.

On the resin-finished samples the tear strength also increased with increasing concentration of caustic up to 45°Tw (ie, from 220 g unmercerized to approximately 500 g mercerized). Double mercerization at 45 and 75°Tw gave the same results as single mercerization at the same concentrations.

Aftertreatment with softener increased the tearing strengths and showed the same relationships at the different caustic concentrations as in the unsoftened samples.

TENSILE STRENGTH (FILLING ONLY) (Figs 5 and 6)———Unmercerized and mercerized samples prior to resin finishing showed very little variation in tensile strength regardless of the concentration of sodium hydroxide used. The strength varied between 43 and 45 lbs on both methods of preparation.

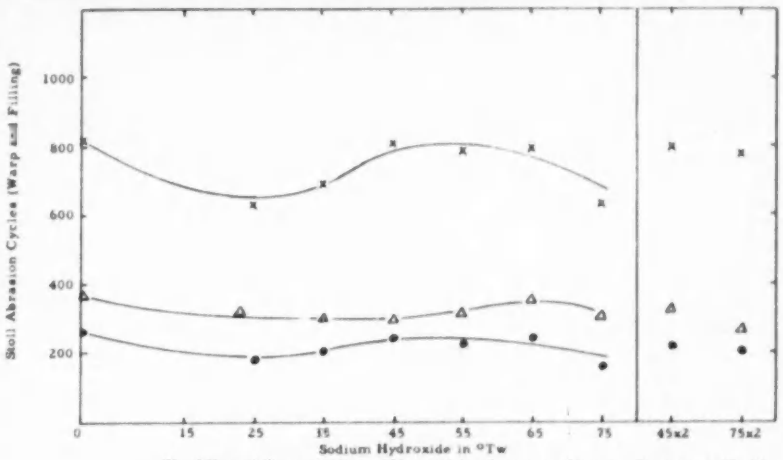
After resinating, the unmercerized goods broke between 25 and 27 lbs, showing a drop of about 40%. As the degree of mercerization increased, the strength reached a maximum of 33 to 35 lbs between 45 and 65°Tw, then declined as 75°Tw was reached. This amounted to a loss of approximately 23% at the maximum (50-60°Tw), as compared with 40% on the unmercerized goods. The tensile strength of cloth double-mercerized was about the same as that of the cloth mercerized once.

CREASE RECOVERY (Figs 7 and 8)———The crease recovery of the unresinated fabric was poor, but there was a slight increase as the degree of mercerization increased. The various degrees of mercerization had no appreciable effect on the crease-recovery angle of the resinated cloth.

SHRINKAGE———On the unresinated samples the shrinkage control was considerably improved by mercerization; however, there were no appreciable differences at various degrees of mercerization. All of the resin-finished samples showed less than 2% shrinkage. They showed no significant differences as the caustic strength was increased.

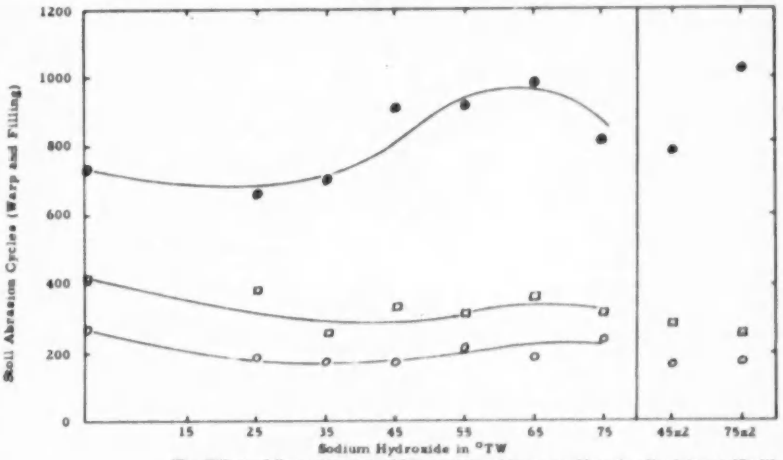
RESISTANCE TO ABRASION (Figs 9 and 10)———The loss in abrasion resistance resulting from resination was constant throughout the range of mercerizations covered.

DEGREE OF CURING———Dye-inhibition tests made on the resinated and cured goods showed adequate curing in all cases. No difference was noted between the samples mercerized at various degrees.



The Effect of Concentration of Mercerizing Liquor on Abrasion Resistance (Stoll). Peroxide Prepare: x, no resin; ●, U-F resin; △, M-F resin.

Figure 9



The Effect of Concentration of Mercerizing Liquor on Abrasion Resistance (Stoll). Kier-Chemic Prepare: ●, no resin; ○, U-F resin; □, M-F resin.

Figure 10

EFFECT OF PREPARE———Both methods of preparation of the cloth (kier-chemic and continuous peroxide) gave essentially the same results in all cases.

SECOND SERIES OF TRIALS———The results of the second series of trials that were run (see Section on "Resin Application") closely paralleled the results obtained in the original trials.

RESIN PENETRATION———The penetration of the urea-formaldehyde resin into both the fabric and the fibers, as shown by cross-sectional photomicrographs (*26*), appeared to be level and complete in all cases. With regard to the melamine-formaldehyde-treated samples, penetration of the fabric was complete, but the distribution was uneven, with more resin at or near the fabric surfaces. The fiber penetration, however, appeared slightly greater in the unmercerized than in the mercerized samples.

RESIN CONTENT———The resin padding formulas were adjusted to give a pickup of 10-12% solids with urea-formaldehyde resin and 6-7% solids with methylated methylolmelamine resin. Actual determinations by both the acid-strip method and Kjeldahl nitrogen analysis confirmed these figures (see Table I). The resin content was found to be the same over the mercerization range studied.

CONCLUSIONS

This study has shown that mercerization of cotton cloth with caustic soda has a

(Concluded on Page P790)

1955 National Convention———

MEASURING THE WHITENING EFFECTS OF FLUORESCENT DYES AND PERBORATE BLEACHES ON COTTON*

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A laboratory technique has been developed for measuring fluorescent and nonfluorescent whitening effects in fabrics. In a series of experiments, by means of two different reflectometers modified either to include or to exclude ultraviolet from the light source, measurements were made indicating the whiteness of undyed cotton test fabrics laundered repeatedly with different detergent solutions containing fluorescent dyes and perborate bleaches. Results showed that the whitening effects produced by the various washing treatments as evaluated by the two instruments were comparable and conformed well with visual observations.

INTRODUCTION

IN connection with research aimed at improving home-laundering methods, the Clothing and Housing Research Branch is focusing attention on materials and methods for whitening and maintaining whiteness in cotton fabrics. Although visual appearance of the laundered cotton helps in differentiating between the efficacy of whitening agents, reliable quantitative measures for evaluating their effects are needed. Reported here is a study of the whitening effects that occurred in undyed cotton fabrics laundered repeatedly with detergent solutions containing fluorescent dyes and perborate bleaches, measured with two different instruments.

INSTRUMENTS FOR MEASURING WHITENESS

One of the instruments used in the study was the Hunter Color and Color Difference Meter *(7)*. This instrument, see Figure 1, is equipped to give three values for each color measured: "R" or light reflectance; "a", which measures redness when plus, gray at zero, greenness when minus; and "b", which measures yellowness when plus, gray at zero, blueness when minus.

To detect the contribution of fluorescent dyes to whiteness, the instrument was modified with slots so that Noviol Shade A *(2)* ultraviolet-absorbing filters could be slid into the two incident beams of light. With these filters in the incident beams, no ultraviolet can reach the fabric specimen and, therefore, only nonfluorescent color is measured. Without the filters, the light of the tungsten source at about 3100°K reaches the specimen unfiltered. Then, for this illumination, the contribution of any fluorescing material, whether caused by the adsorption of a fluorescent dye or a chemical modification of the fabric, is included in the color measured by the instrument. From the readings for unwashed and washed fabrics, changes in reflectance and chromaticity brought about by the different whitening treatments were calculated in terms of NBS units of color difference *(6)* according to the formula:

$$\triangle E = \sqrt{\triangle L^2 + \triangle a^2 + \triangle b^2},$$

where $\triangle E$ is color difference in NBS units, $L = 10\sqrt{R}$, and a and b are chromaticity measures.

The second instrument was a preliminary model of a fluorescence-sensitive reflectometer *(3)* developed by the Hunter Associates Laboratory. This instrument, see Figure 2, measures only blue reflectance but, as with the color-difference meter, measurements can be made with the ultraviolet of the tungsten source at 3100°K either included or excluded from the incident light. It is also possible with this fluorescence-sensitive reflectometer to enhance the fluorescence contribution to blue reflectance by placing another filter *(2)* in the incident beam, which passes all the nearby ultraviolet wave lengths and only the shorter of the blue region of the spectrum.

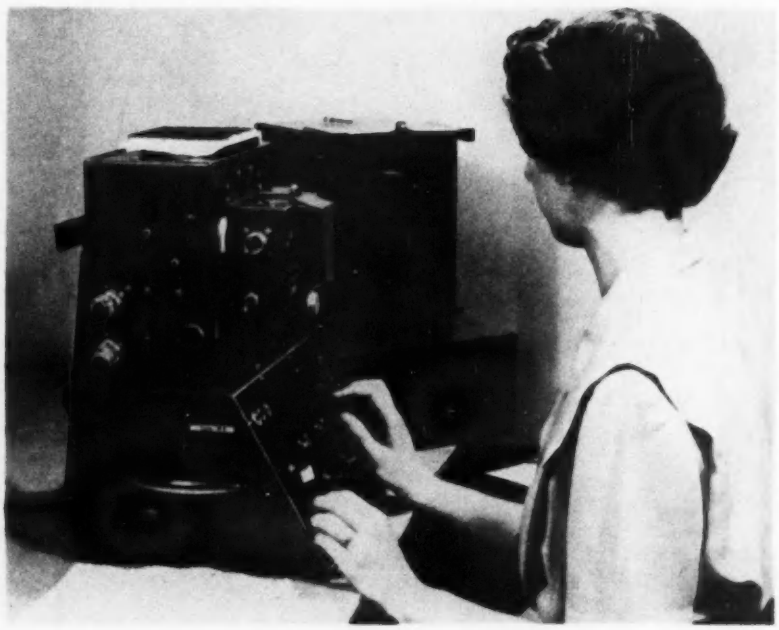

Figure 1
The Hunter Color and Color Difference Meter

* Presented by Margaret S Furry before the Symposium on Laundering, Drycleaning & Garment Dyeing, which was held on Sept 23, 1955 in the West Room of the Haddon Hall, Atlantic City, N J.

Blue reflectance, such as is measured by this instrument, is a practical, simplified measure of whiteness, combining in one figure departures from ideal whiteness toward both grayness and yellowness. Grayness is caused by nonselective absorption throughout the spectrum, yellowness by selective absorption in the blue only. Thus, in the blue one can measure the combined effects of both types of absorption.

Since fluorescing materials whiten fabrics by converting ultraviolet incident light to visible blue light, measurements of blue reflectance also include the contribution of fluorescent dyes to whiteness as well as any fluorescence effect due to chemical modification of the fabric. The change in blue reflectance due to fluorescence of fabrics laundered with the various bleaching conditions was calculated from the reflectance readings with each blue filter at the different wash periods according to the formula:

$$\text{Percent fluorescence} = \frac{R_{uv} - R_{excl}}{R_{excl}} \times 100,$$

where R_{uv} is the reflectance with ultraviolet in the light source, and R_{excl} is the reflectance with ultraviolet excluded from the light source. The percent increase in blue reflectance of the fabrics due to repeated laundering was also calculated from reflectance readings for unwashed and washed fabrics, both with ultraviolet in the light source and with ultraviolet excluded from the light source.

Incandescent light, which has relatively less ultraviolet than natural daylight, was used in both instruments. Therefore, the measured fluorescence contributions are smaller than those which occur in natural daylight. Since there is no single visually preferable white (some people prefer a bluish white, others a neutral or even yellowish white), the data obtained here should be considered to give relative rather than absolute whiteness trends.

MATERIALS AND PROCEDURES

The two detergents selected for this study included 1) an industrial chip soap containing 92.5 percent anhydrous soap and small amounts of moisture and neutral salts, and 2) a household synthetic detergent (syndet) having 18.7 percent active ingredient, a little moisture, various complex phosphates, and a fluorescent dye. The type and amount of the fluorescent dye used in the detergent were not determined.

A fluorescent dye, Calcofluor White MR Conc, was used with soap in some of the washing treatments. It was added to the soap solution, 0.06 percent fluorescent dye based on the weight of the soap, before the test fabric was immersed.

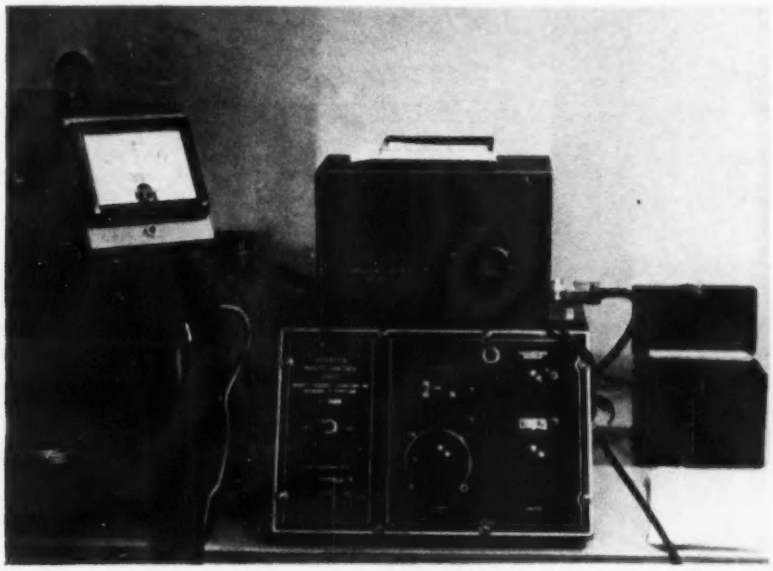

Figure 2

The fluorescence-sensitive reflectometer

The sodium perborate, the only oxidizing bleach used in this study, had an active oxygen content of 10 percent. The chemical, $NaBO_3 \cdot 4H_2O$, was used as received.

The cotton test fabrics used for evaluating the whitening effects of the fluorescent dyes and perborate bleaches included a percale sheeting in the unbleached or gray state and a fully bleached percale sheeting of the same construction. The unbleached fabric was obtained as it came off the loom before it was shrunk in the finishing operation. It was 50 inches wide, had 98 yarns in the warp and 99 in the filling, and weighed 4.3 oz/sq yd. The bleached fabric was 45" wide with 105 yarns in the warp and 91 in the filling, and weighed 3.9 oz/sq yd. Color measurements of "R", "a" and "b" for the unbleached fabric were 71 percent, −1.4, and +11.9; for the bleached (desized) fabric 90 percent, −0.2, and +2.9, respectively.

The unbleached fabric was used as received; the bleached fabric was desized *(1)*. Samples of the test fabrics, approximately square and weighing 10 ± 0.2 grams each, were cut from the materials, and in order to get them into relaxed condition, were wet in distilled water at 40°C and spread flat on plate glass to air dry.

Each fabric sample was washed separately in 250 ml of the test solution (in distilled water) at 60°C in a pint jar in a Launder-Ometer operated at 42 rpm for 15 minutes, rinsed twice in beakers in distilled water at 60°C for one minute each, then spread flat on plate glass to dry. Launderings were done with a 0.10 percent concentration of each of the detergents as received and 0.05 and 0.15 percent concentrations of the sodium perborate. To some of the soap solutions 0.00006 percent fluorescent dye was added. For each set of washing conditions two replicates were used. To determine the accumulative effect of the fluorescent dyes and perborate bleaches, samples were washed and dried 50 times.

Reflectance and chromaticity measurements of the fabric samples were made on the two instruments before laundering and after 1, 10, 20, 30, 40, and 50 washes. Each sample was read in the same two places before and after laundering. For the reading the sample was folded and four thicknesses were backed by the porcelain enamel "white" standard used in balancing the instrument.

MEASUREMENTS ON HUNTER COLOR AND COLOR DIFFERENCE METER

Reflectance and chromaticity changes in both the unbleached and bleached cotton fabrics on repeated laundering were toward lighter and bluer colors. As was expected, changes in the samples increased with increasing number of launderings.

Figure 3 shows color differences in NBS units between the unwashed unbleached and bleached test fabrics and the corresponding materials washed 50 times in bleach and detergent solutions.

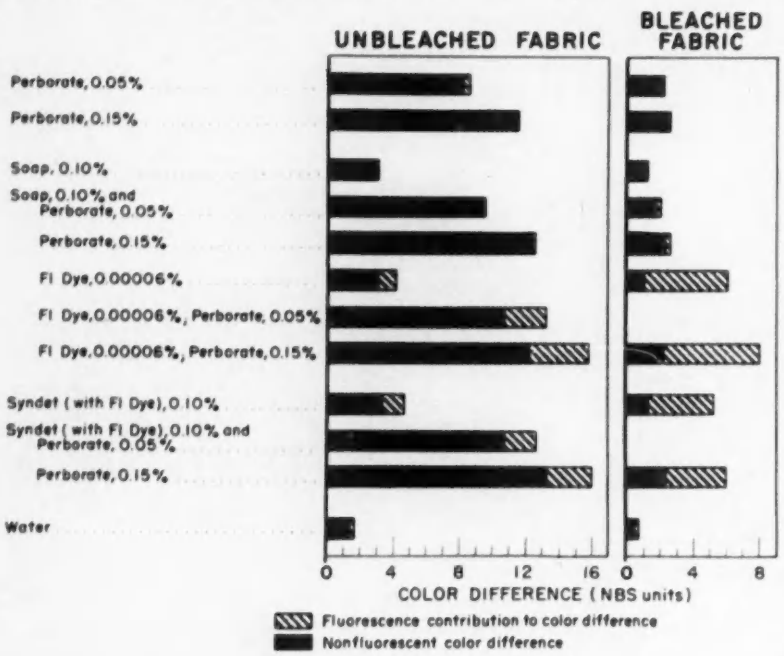

Figure 3

Color difference in cotton test fabrics washed 50 times in bleach and detergent solutions, compared to the corresponding unwashed material

The whitening effects due to fluorescence, also those due to nonfluorescent color changes produced by the different washing treatments, are indicated. The data were not analyzed statistically. Workers in this study, however, were able to distinguish visually in both north daylight and incandescent light between fabric samples having a difference of only one NBS unit. Therefore, color changes of that magnitude and greater are considered significant.

In the unbleached fabric sodium perborate, in the amounts used in this study, had greater whitening effect on repeated laundering than did the fluorescent dyes included with the soap and synthetic detergent. As indicated by changes in reflectance, "a" and "b" values, sodium perborate greatly reduced grayness and yellowness in the test fabric. The two fluorescent dyes used with the detergents reduced yellowness and greenness in the unbleached fabric; they had little effect on grayness.

The changes in color produced by 50 washings of the unbleached fabric in some of the bleach and detergent solutions, are shown in Table I. Readings were made with ultraviolet in the light source, except where noted. Reflectance, "a" and "b" values for the unwashed unbleached fabric were 71 percent, −1.4 and +11.9, respectively.

Sodium perborate used with the fluorescent dyes enhanced their fluorescence effects and produced increased whitening in the unbleached fabric. With the light source and the test conditions used, changes in some cases were beyond neutral white. For instance, unbleached samples washed 50 times with detergents containing fluorescent dyes and the higher amount of perborate had some redness in the fabric. This effect was apparent first in measurements made at the 30-wash period.

In the bleached test fabric, the whitening effects produced by the fluorescent dyes and perborate bleaches were somewhat different from those in the unbleached fabric. The results in Table II show the changes in reflectance and chromaticity that took place in the bleached test fabric in 50 washings. These data were from readings made with ultraviolet in the light source, except as noted. Reflectance, "a" and "b" values for the unwashed fully bleached test fabric were 90 percent, −0.2 and +2.9, respectively.

With the bleached fabric, the sodium perborate treatments produced less color changes in the test samples than the treatments using fluorescent dyes. Samples washed 50 times in the higher amount of perborate were effectively whitened and, according to color readings with the light source and instrument used, were nearly white. Some of the perborate-treated samples, however, showed fluorescence, indicating that chemical modification of the fabric may have occurred *(4, 5)*.

The fluorescent dye used with the soap produced greater color changes in the bleached test fabric than the fluorescent dye included in the syndet. With both fluorescent dyes, under the test conditions used, the effect at first was to add to the

TABLE I

COLOR CHANGES IN UNBLEACHED COTTON TEST FABRIC WASHED 50 TIMES IN BLEACH AND DETERGENT SOLUTIONS

Concentration of solution	*Reflectance increase*	*"a" increase*	*"b" decrease*	*Color difference*
				(NBS units)
Perborate, 0.05%	13	0.1	4.5	8.5
Perborate, 0.15%	17	0.6	7.3	11.5
Soap, 0.10%	5	0.7	1.2	3.0
Soap, 0.10%; fluorescent dye, 0.00006%	5	1.4	2.6	4.1
Soap, 0.10%; fluorescent dye, 0.00006%; perborate, 0.15%	18	2.7	11.8	15.8
Ultraviolet excluded	19	0.2	6.5	12.2
Syndet (with fluorescent dye), 0.10%	5	1.4	3.3	4.6
Syndet (with fluorescent dye), 0.10%; perborate, 0.15%	20	2.0	11.5	16.0
Ultraviolet excluded	20	0.6	7.8	13.3

TABLE II

COLOR CHANGES IN BLEACHED COTTON TEST FABRIC WASHED 50 TIMES IN BLEACH AND DETERGENT SOLUTIONS

Concentration of solution	*Reflectance increase*	*"a" increase*	*"b" decrease*	*Color difference*
				(NBS units)
Perborate, 0.05%	2	0.2	1.9	2.2
Perborate, 0.15%	2	0.2	2.2	2.6
Soap, 0.10%	1	0.1	1.0	1.1
Soap, 0.10%; fluorescent dye, 0.00006%	1	2.0	5.7	6.1
Soap, 0.10%; fluorescent dye, 0.00006%; perborate, 0.15%	2	2.4	7.5	8.0
Ultraviolet excluded	2	0.2	1.8	2.2
Syndet (with fluorescent dye), 0.10%	1	1.4	5.1	5.3
Syndet (with fluorescent dye), 0.10%; perborate, 0.15%	3	1.6	5.7	6.1
Ultraviolet excluded	2	0.2	2.0	2.4

whiteness of the fabric. Readings for samples washed only 10 times in each of the detergent-fluorescent dye solutions, however, indicated redness and blueness in the fabric, and with 50 washes showed a considerable build-up of color. By visual appearance the final colors were still acceptable, especially to observers who preferred a bluish white.

The fluorescent dyes were much more effective on the bleached test fabric than on the unbleached. One might expect the opposite to be true, since the unwashed unbleached fabric, being so much less white than the unwashed bleached fabric, would seem to be more amenable to all whitening treatments. On unbleached fabric, however, the natural yellowish compounds within the fabric compete with the fluorescent dyes in absorbing ultraviolet light. Only the ultraviolet absorbed by the fluorescent dye is converted to blue light to make the fabric appear white; that absorbed by the yellow compounds is lost. The yellowish or unbleached cloth, therefore, shows less whitening by fluorescent dyes than the white or fully bleached cloth.

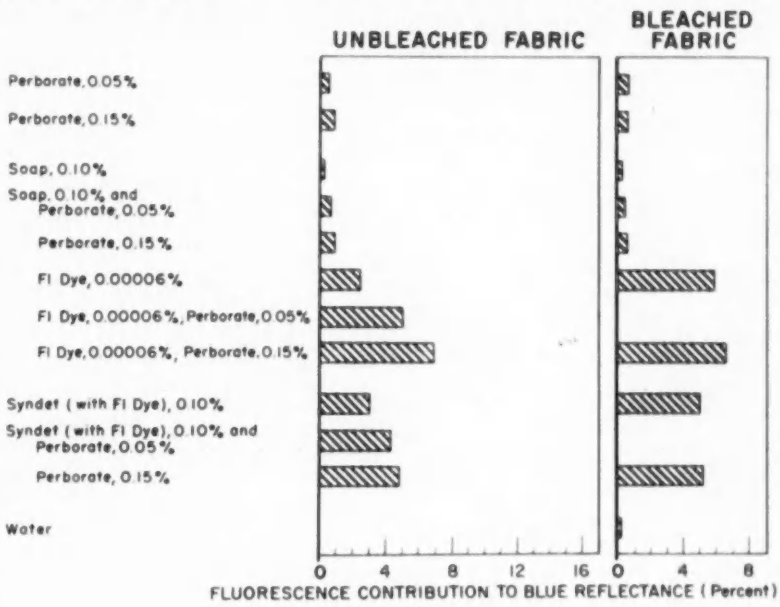

Figure 4

Fluorescence contribution to blue reflectance of cotton test fabrics washed 50 times in bleach and detergent solutions

MEASUREMENTS ON FLUORESCENCE-SENSITIVE REFLECTOMETER

The whitening effects produced by fluorescence in the unbleached and bleached cotton fabrics washed 50 times in detergent and bleach solutions as measured on the fluorescence-sensitive reflectometer are shown in Figure 4. Results are expressed in terms of the percent fluorescence contribution to blue reflectance of the test fabric laundered by the particular washing treatment.

With repeated laundering all the detergent and bleach treatments produced fluorescence in the test materials. As expected, laundering of the fabrics in detergent-fluorescent dye solutions contributed greater fluorescence effects than laundering with the perborate bleaches. For the most part the fluorescent dyes were more effective on the fully bleached than on the unbleached fabric. Sodium perborate used with the fluorescent dyes enhanced their whitening effects. Indications are that sodium perborate caused some chemical damage to the test fabrics, since treatments using perborate alone and perborate combined with soap produced considerable fluorescence in both materials *(4, 5)*.

These results for fluorescent whitening (Figure 4) calculated from blue reflectance measurements correspond to and should be compared with data for fluorescence contribution to color difference obtained from readings on the Hunter Color and Color Difference Meter

TABLE III

FLUORESCENCE IN COTTON TEST FABRICS WASHED 50 TIMES IN BLEACH AND DETERGENT SOLUTIONS

Concentration of solution	*Fluorescence contribution to blue reflectance, measured on fluorescence-sensitive reflectometer*		*Fluorescence contribution to color difference, measured on color difference meter*	
	Unbleached fabric	*Bleached fabric*	*Unbleached fabric*	*Bleached fabric*
	(%)	(%)	(NBS units)	(NBS units)
Perborate, 0.05%	0.5	0.6	0.4	0.1
Perborate, 0.15%	0.9	0.6	0	0
Soap, 0.10%	0.2	0.3	0	0.1
Soap, 0.10%; perborate, 0.05%	0.6	0.5	0	0.2
Soap, 0.10%; perborate, 0.15%	0.9	0.6	0.1	0.3
Soap, 0.10%; fluorescent dye, 0.00006%	2.4	5.9	1.1	5.1
Soap, 0.10%; fluorescent dye, 0.00006%; perborate, 0.05%	5.1	—	2.5	—
Soap, 0.10%; fluorescent dye, 0.00006%; perborate, 0.15%	6.9	6.6	3.6	5.8
Syndet (with fluorescent dye), 0.10%	3.0	5.1	1.3	4.0
Syndet (with fluorescent dye), 0.10%; perborate, 0.05%	4.3	—	1.9	—
Syndet (with fluorescent dye), 0.10%; perborate, 0.15%	4.8	5.2	2.7	3.7
Water without bleach or detergent	0	0.2	0.2	0.1

TABLE IV

NONFLUORESCENT WHITENING IN COTTON TEST FABRICS WASHED 50 TIMES IN BLEACH AND DETERGENT SOLUTIONS, COMPARED TO CORRESPONDING UNWASHED MATERIAL

Concentration of solution	*Nonfluorescent blue reflectance increase, measured on fluorescence-sensitive reflectometer with ultraviolet excluded*		*Nonfluorescent color difference, measured on color difference meter with ultraviolet excluded*	
	Unbleached fabric	*Bleached fabric*	*Unbleached fabric*	*Bleached fabric*
	(%)	(%)	(NBS units)	(NBS units)
Perborate, 0.05%	23.1	4.6	8.1	2.1
Perborate, 0.15%	32.6	5.4	11.5	2.6
Soap, 0.10%	7.2	2.4	3.0	1.0
Soap, 0.10%; perborate, 0.05%	26.4	3.9	9.5	1.8
Soap, 0.10%; perborate, 0.15%	34.5	5.0	12.4	2.3
Syndet (with fluorescent dye), 0.10%	8.5	3.0	3.3	1.3
Syndet (with fluorescent dye), 0.10%; perborate, 0.15%	36.2	5.2	13.3	2.4

(see cross-hatched bars, Fig 3). Fluorescence effects produced by the different treatments as measured by the two instruments are in good agreement. For convenience in comparing results, values obtained with the two instruments are shown in Table III.

In order to detect small amounts of fluorescence in fabrics, it is possible to exaggerate fluorescence with the fluorescence-sensitive reflectometer by substituting Corning filter number 5850 in the reflectometer for the usual Corning filter number 5543. For instance, with filter number 5543, the fluorescence values for unbleached fabric washed 50 times in soap-fluorescent dye solutions without perborate and with 0.05 and 0.15 percent of perborate, are 2.4 percent, 5.1 percent, and 6.9 percent, respectively; corresponding values with filter number 5850 are 5.0 percent, 11.2 percent, and 16.0 percent. Measurements showed almost perfect correlation between the two filters.

The nonfluorescent changes in blue reflectance produced by the different washing treatments also effectively whitened the test fabrics. Repeated laundering with sodium perborate solutions markedly increased the blue reflectance of both fabrics. In Table IV are results showing the percent increase in nonfluorescent blue reflectance of fabrics that occurred in 50 launderings. For comparison, corresponding data on the nonfluorescent color difference in fabrics washed 50 times obtained with the color difference meter (Fig 5) are included. Readings on the two instruments were made with ultraviolet excluded from the light source.

CONCLUSIONS

The two instruments investigated here for measuring fluorescent and nonfluorescent whitening effects in fabrics gave comparable results that conformed well with visual observations.

The Hunter Color and Color Difference Meter, modified either to include or to exclude ultraviolet from the light source, was used to measure the changes in reflectance and chromaticity in undyed cotton test fabrics laundered repeatedly with different detergent solutions containing fluorescent dyes and perborate bleaches. Results effectively indicated the contribution of fluorescence to whiteness. Many of the washing treatments produced redder and bluer whites.

The second instrument, a recently developed fluorescence-sensitive reflectometer, measured changes in blue reflectance of the laundered test fabrics with ultraviolet both included and excluded from the light source. Since blue reflectance combines the effects of both grayness and yellowness, it proved a practical measure of fluorescent and nonfluorescent whiteness for the fabrics and test conditions used. With this instrument small amounts of fluorescence could be detected.

ACKNOWLEDGMENT

Grateful acknowledgment is given to Richard S Hunter, Hunter Associates Laboratory, Falls Church, Va, for suggestions concerning this report.

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Mercerization

(Concluded from Page P785)

beneficial effect on some of the physical properties of resin-treated fabrics.

Loss in tensile and tear strength, which normally results from resination, is materially reduced by premercerization. The addition of softener, either to the resin padding liquor or as an aftertreatment, improves the tear strength still further.

The optimum strength for the caustic mercerizing liquor is 45-65°Tw.

Mercerization appears to have little effect on crease recovery, resistance to abrasion, or shrinkage control.

It is interesting to note that a definite correlation was found between the degree of mercerization efficiency (as measured by the Barium number, dye absorption and dyeing tests), and the improvement noted in the physical properties of the fabric.

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Northern New England Section and Lowell Technological Institute Student Chapter —

THE EFFECT OF ADDITIVES TO THERMOSETTING RESIN BATHS ON THE PHYSICAL PROPERTIES OF THE TREATED FABRIC*

THOMAS F GARVEY

A study was made of the changes in the physical properties of resin-treated fabrics resulting from the addition of elastomers, thermoplastic resins, thermosetting resins, repellents, and softeners to a normal thermosetting-resin finishing bath.

It was found that the physical properties were modified by the addition of these materials. Some of the agents studied markedly increased the tear strength, abrasion resistance, and wrinkle recovery of resin-treated fabrics.

INTRODUCTION

THE ease of wrinkling of cellulosic materials has long been recognized as an undesirable characteristic. The molecules of cellulose are oriented to some extent along the axis of the fiber as shown in Figure 1 *(1)*. The hydroxyl groups in neighboring molecules have a tendency to form hydrogen bonds. When a bending force causes the molecules to slip past each other the bonds between some of the hydroxyl groups are broken and re-established in new positions. This causes the fibers to remain bent and, therefore, a wrinkling or creasing of the fabric occurs.

The ability of a fabric to resist the formation of a crease or wrinkle when lightly squeezed is termed "the crease resistance of the fabric," and it is associated with the fabric stiffness. A crisp fabric that does not bend easily resists the formation of a crease and may be termed *crease resistant*.

The ability of a fabric to recover to a definite degree from a sharp crease is termed "the crease recovery of the fabric." Since this deals with the internal linking of the molecules within the fiber, it can best be modified by chemicals which will penetrate the fiber.

Foulds, March, and Wood *(2)* discovered in 1929 that the wrinkle recovery of cellulosic fabrics is remarkably increased by the proper application of thermosetting resins. The mechanism by which internal deposition of resin modifies the fiber properties has received a great deal of attention. It has been shown that these resins have the ability to crosslink the cellulose molecules. These crosslinkages may not necessarily be primary valence bonds, but could simply involve hydrogen bonding between the hydroxyl groups on the cellulose and the amide linkages on the resin polymer. Either type of linkage results in the formation of bridges between the cellulose macromolecules.

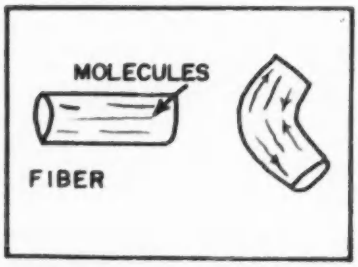
Wood *(3)* has declared that the modification of viscose in the creaseproofing process is due to the presence of resin deposited in the amorphous area of the fiber. It is now generally believed that cellulosic materials are modified by both the mechanisms mentioned. A certain amount of resin helps form crosslinkages, and the excess is simply deposited in the amorphous areas of the fiber; however, the entire amount is effective in modifying the fiber properties.

The presence of strong bonds between the adjacent molecules reduces the possibility of internal slippage, thus increasing the elastic elongation of the fiber. The presence of resin in the amorphous area of the fiber prevents the reformation of the broken crosslinkages and, thereby, decreases the ultimate extensibility of the fiber. It can be seen from this that the proper application of resin increases the crease-recovery properties of the fabric.

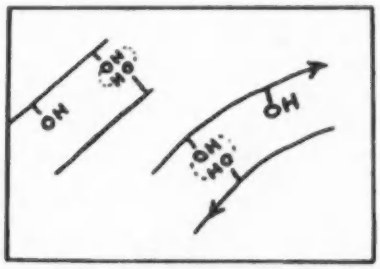
The introduction of strong crosslinkages and internally deposited resin is bound to change the physical characteristics of the fiber. Agents used for wrinkle-proofing and fabric stabilization decrease the swelling of the fiber, decrease the fiber's ultimate extensibility, and increase the fiber's elastic elongation. These fiber properties may be extended to cover the fabric properties. This correlation of changes in fabric properties with changes in fiber properties has not always been given sufficient attention.

A decrease in the tear strength and abrasion resistance occurs upon the application of a resin to improve the fabric's crease recovery. These properties are related to the capacity of the fiber to absorb energy. Since the fiber's extensibility is lowered its ability to absorb energy is decreased.

Many feel that this decrease in tear strength and abrasion resistance is due to cellulose degradation, either through oxidation or hydrolysis. Gagliardi and



SLIDING OF MOLECULES WHEN A TEXTILE FIBER IS BENT.



BONDS BETWEEN CELLULOSE MOLECULES ARE BROKEN AND REFORMED.

Figure 1

* This paper is a condensation of a thesis performed by the author, under the direction of Professor John J McDonald, for the degree of Master of Science at Lowell Technological Institute. It was presented on April 22, 1955, at a joint meeting of the Northern New England Section and the Lowell Technological Institute Student Chapter.

Nuessle *(4)* have shown that, upon the removal of the resin from a spun-viscose challis, the original properties of the fabric are restored. This would be impossible if any oxidation or hydrolysis of the cellulose had occurred, since these reactions are irreversible.

Various agents have been added to the resin bath by the finisher in an effort to change certain fabric characteristics, such as hand, body, and appearance, along with the physical properties of tear strength and abrasion resistance. The term *additives* is used to designate compounds in the applied bath that supplement the basic formulation of resin and catalyst.

Unfortunately the utilization of these additives by the finisher has been directed towards acquiring a single physical property with little or no regard to the effect that they may have on the other properties of the fabric. There are many agents available that may be used as additives. Some finishers have discovered certain agents that are useful as additives, but this information is usually carefully confined to the plant.

There is a definite need in the textile-finishing field for an unbiased and non-commercial study of the effect of additives.

EXPERIMENTAL

A junior butcher spun-viscose fabric was used in this investigation because of the difficulty encountered in improving its physical characteristics. The fabric was wet processed in the normal manner. It had a dyed (but unfinished) weight of 6 oz/yd and a construction of 50 x 50.

All test samples were padded in a three-roll Butterworth Laboratory Pad using a double dip-double nip threading with a roll-gauge pressure of 45 psi. This pressure gave approximately 100% wet pick-up. The samples were dried and cured. They were then washed, using a built, nonionic detergent at 160°F for 20 minutes. (Denio and Wood *(5)* have shown that this procedure removes all unfixed resin. This process eliminates residual odors, gives a softer hand, and decreases the loss of additive in subsequent washings. The fabric was then dried and allowed to condition. Preliminary experiments were run to determine the amount of resin, the amount of catalyst, the time and temperature of curing, and the amounts of additive to be used.

The general formulation used in the application of all the additives was: 9% resin solids of Aerotex 802(75%), which is a modified urea-formaldehyde resin with 4% Catalyst LP and 5, 10, and 20% additive based on the resin solids.

All tests were made on the filling yarns so as to eliminate the testing of edge samples. The following physical properties were tested on the equipment specified:

1) Wrinkle recovery on the Monsanto Wrinkle-Recovery Tester
2) Degree of resilience on the Instron using the automatic integrator
3) Tear strength on the Elmendorf Tear Tester
4) Abrasion resistance on the Stoll Flex Tester

The machines used and the testing procedures followed were selected to give the most useful information concerning the fabric properties.

DISCUSSION OF RESULTS

Analysis of the results shows that the additives have certain optimum concentrations, which vary with each compound used. These specific concentrations are fairly critical in that variations from them may cause serious increases in detrimental characteristics.

The additives may be grouped into five classifications:

1) Elastomers
2) Thermoplastic resins
3) Thermosetting resins
4) Repellents
5) Softeners

These additives may react with the cellulose or with the resin, or they may be simply deposited on the surface of or within the fiber. The physical and chemical properties of the commercially available compounds were considered before a compound was chosen to be used as an additive.

Hycar 1562 is an elastomer containing acrylonitrile and butadiene with an antioxidant added. It has the ability to coat the surface of the fibers and add its properties to those of the basic resin fiber.

Merlon KR-4 is an aqueous dispersion of polyvinyl acetate and, therefore, is a thermoplastic resin.

Resloom M-75 is a modified melamine-formaldehyde condensate. It acts with the basic resin.

Prym S is a modified urea-formaldehyde thermosetting resin, which has different properties from those of the basic resin.

Zelan AP Paste is a quaternary ammonium compound, which acts as both as internal and external lubricant.

Aquapel S-437 is a ketene dimer product, which acts as both an external and internal lubricant.

105 Emulsion is a silicone compound, which acts as a lubricant on the surface of the fibers.

Aerotex Softener H is a cationic softener. It was not found to be as durable a finish as the others applied. If a less severe afterwash had been used, this compound might have shown greater improvement in the values tested.

Each additive was applied using concentrations of 5, 10, and 20% based on the weight of the resin solids. The concentration that produced the best effect as judged by a general consideration of all the values tested was chosen as the optimum concentration for that additive. The optimum concentration varies with each additive and is influenced by the nature of the additive and the mechanism by which it acts. Table I shows the mean values of the additives for all the values tested and the standard error obtained by statistical analysis of the test results.

The numerical values obtained in these tests will not be emphasized because they are primarily a function of the cloth.

WRINKLE RECOVERY —— Figure 2 illustrates the effect of additives on the wrinkle-recovery performance of the cloth. The Monsanto Wrinkle-Recovery Tester was used according to Federal Specifications CCC-T-191b (Method 5212).

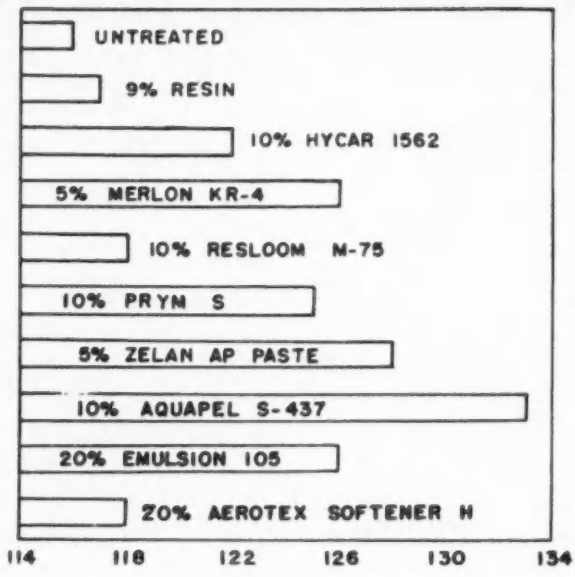
The untreated fabric was processed in the same manner as the fabrics with additives applied, but was padded with a solution of water alone.

As can be observed, the addition of the resin slightly increased the wrinkle recovery. Although smaller percentages of resin gave a larger increase in wrinkle recovery, the higher percentage of resin was applied to better show the effect of the additives.

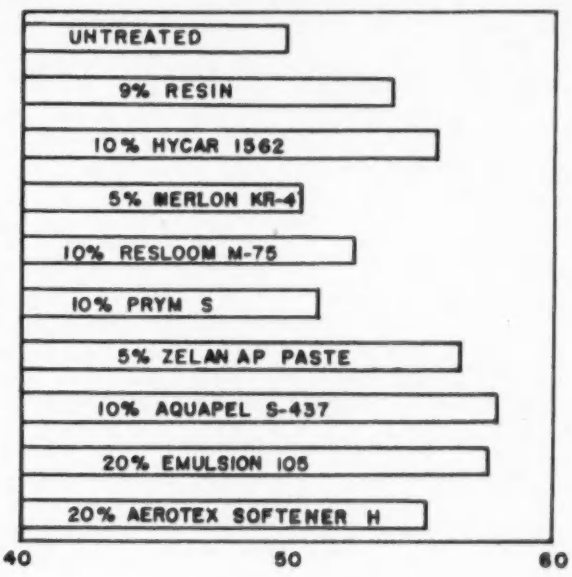
Hycar 1562 produced better results than the other Hycar compounds tested. Merlon KR-4 produced better characteristics than the other Merlon compounds,

TABLE I
MEAN VALUES OF VARIOUS ADDITIVES FOR ALL VALUES TESTED

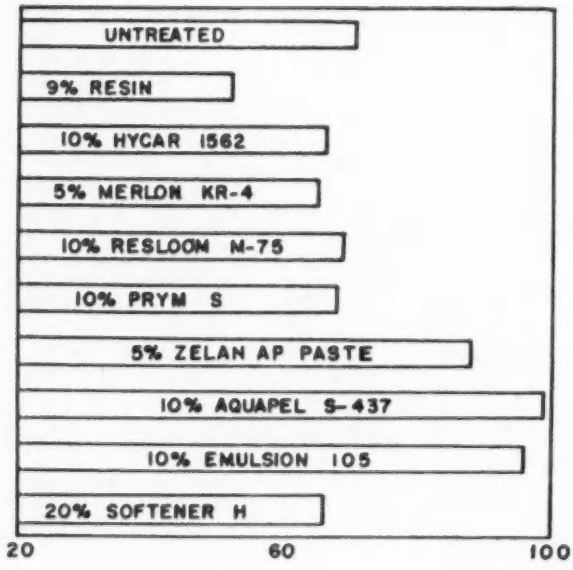
	Wrinkle Recovery (Monsanto Deg)	*Degree of Resilience*	*Tear Strength (Elmendorf Units)*	*Abrasion Resistance (Cycles)*
Untreated	116 ± 3	49.9 ± .3	71 ± 3	1440 ± 162
9% resin	117 ± 2	53.9 ± .4	52 ± 1	929 ± 106
10% Hycar 1562	122 ± 2	55.6 ± .8	66 ± 2	1934 ± 79
5% Merlon KR-4	126 ± 4	50.5 ± 1.3	65 ± 3	1415 ± 136
10% Resloom M-75	118 ± 2	52.5 ± .7	69 ± 4	1422 ± 168
10% Prym S	125 ± 3	51.2 ± .7	68 ± 4	1154 ± 198
5% Zelan AP Paste	128 ± 3	56.6 ± .4	90 ± 4	1199 ± 46
10% Aquapel S-437	133 ± 3	57.9 ± .3	99 ± 1	2285 ± 311
20% Emulsion 105	126 ± 2	57.6 ± .3	96 ± 2	1838 ± 153
20% Aerotex Softener H	118 ± 2	55.3 ± .4	86 ± 4	1924 ± 214



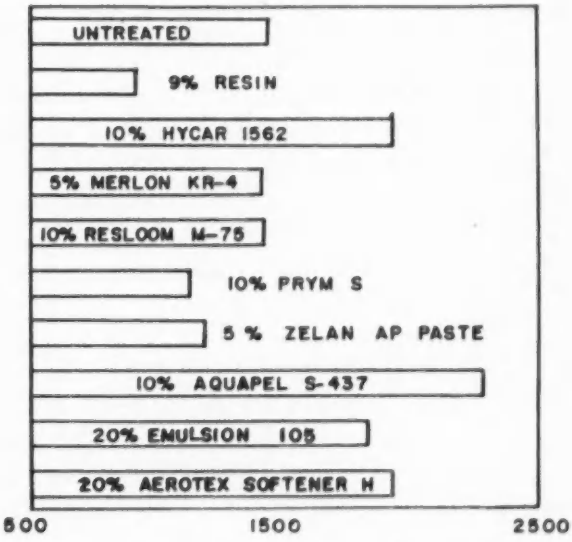
WRINKLE RECOVERY
Figure 2



DEGREE OF RESILENCE
Figure 3



TEAR STRENGTH (ELMENDORF UNITS)
Figure 4



ABRASION RESISTANCE (FLEX)
Figure 5

such as KR-2 and KR-3, which were also tested.

Both Merlon KR-4 and Hycar 1562 are thermoplastic in nature, but the Hycar has butadiene added. Merlon KR-4 produced a greater increase in wrinkle recovery than did the Hycar probably because it forms a tougher, more pliable film on the surface of the fibers.

Resloom M-75 only slightly increased the wrinkle recovery while Prym S, another thermosetting resin, considerably improved the wrinkle recovery. The improvement for each is determined by the mechanism with which the additive acts with the basic resin.

Zelan AP Paste, Aquapel S-437, Emulsion 105, and Aerotex Softener H acted as lubricants in the concentrations used. The improvement in wrinkle recovery is probably a function of their efficiency as lubricants for these compounds allow the fibers to slip, thereby facilitating the removal of creases.

DEGREE OF RESILIENCE——Figure 3 illustrates the effect of additives on the degree of resilience of the cloth. The degree of resilience was measured on the Instron Tester using the automatic integrator. The fabric was loaded at one in/min to approximately 4% of its break-

ing strength, and then unloaded at the same rate.

The addition of resin to the fabric increased the fiber's elastic elongation. The further addition of a thermoplastic or thermosetting resin tends to decrease the degree of resilience, as shown by Merlon KR-4, Resloom M-75, and Prym S.

The elastomer, Hycar 1562, increased the degree of resilience because of the elastic nature of the film that contained butadiene.

All the lubricants increased the degree of resilience, as might be expected, because of their lubricating powers.

TEAR STRENGTH——Figure 4 illustrates the effect of additives on the tear strength of the fabric. The Elmendorf Tear Tester was used according to Federal Specification CCC-T-191b (Method 5132).

In these tests the tear was made in the shorter direction of the sample, which is contrary to the standard testing procedures. This change was decided upon since the actual readings are a function of the fabric alone, and with the application of certain additives the tear strength would have exceeded the capacity of the machine.

The application of a resin caused an appreciable decrease in the tear strength of the fabric. This is due to a decreased ability to absorb energy resulting from a decrease in the extensibility of the fibers.

The addition of the thermoplastic and thermosetting resins caused an increase in the tear strength, but the tear strength did not exceed the original tear strength of the untreated fabric.

The lubricants caused a very great increase in the tear strength, and some even produced a higher tear strength than the original fabric. Aquapel gave the largest increase, while Softener H did not produce any better results than the other resin additives. The lubricants allowed the fibers to slip and, thereby, distribute the tearing force.

ABRASION RESISTANCE——Figure 5 illustrates the effect of additives on the abrasion resistance of the fabric. The Stoll Quartermaster Universal Wear Tester was used according to Federal Specification CCC-T-191b (Method 5300). The pressure plate was loaded with a 0.5-lb weight, and the tension bar had a 1-lb weight placed on it.

The addition of a resin caused a decrease in the ability of the fibers to absorb work and thus lowered their ability to resist abrasion.

The thermoplastic resins coat the fibers and the abrasion resistance is thus increased. Hycar 1562 forms a film which adheres better to the fibers and gives a large increase in abrasion resistance.

Both thermosetting resins slightly improve the abrasion resistance. This increase is a function of their effect on the surface of the fibers and their effect on the fiber's extensibility.

The lubricants coat the surface and increase the abrasion resistance. As can be seen, Aquapel S-437 caused a very great increase; its abrasion resistance far exceeded that of the original untreated fabric.

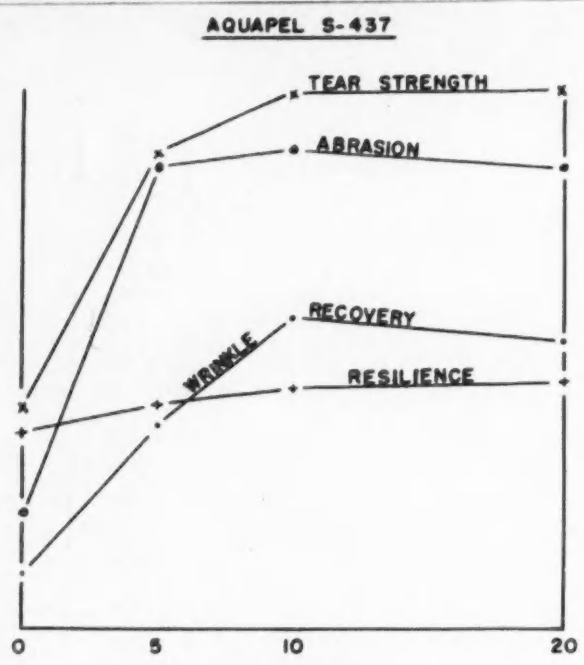


Figure 6

SUMMARY——Aquapel S-437 gave excellent results in all the tests. Figure 6 shows the effect of varying its concentration upon all the properties tested. Again the units have been omitted because they are a fraction of the fabric alone.

The wrinkle recovery, tear strength, and abrasion showed very great increases while the degree of resilience exhibited only a slight increase.

The effect of concentration as shown in Figure 6 is not typical of all the compounds. Many of the other additives showed optimum concentrations, and higher concentrations produced serious decreases in all the properties tested.

CONCLUSIONS

1) Additives may improve the wrinkle recovery, degree of resilience, tear strength, and abrasion resistance properties of the fabric.

2) The improvement of the tested values by the elastomers and thermoplastic resins appears to be a function of the nature of the film formed on the surface of the fibers.

3) The improvement of the tested values by the softeners and repellents seems to depend upon their lubricant power.

4) Wrinkle recovery is greatly increased by both Aquapel S-437 and 105 Emulsion.

6) Tear strength is markedly increased by Zelan AP Paste, Aquapel S-437, and 105 Emulsion.

7) Abrasion resistance is most markedly increased by Hycar 1562 and Aquapel S-437.

8) Many additives exhibit extremely critical optimum concentrations.

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Washington Section———

TEXTILES AT THE NATIONAL BUREAU OF STANDARDS*

W D APPEL

Textiles Section
National Bureau of Standards
Washington, D C

The work of the National Bureau of Standards on textiles deals very largely with properties and their measurement, relationship to the chemical and physical structures of fibers, yarns, and fabrics, and representation in standards. The current work on textiles is outlined and related to the statutory functions of the National Bureau of Standards. Some accomplishments are pointed out as examples of the services of the NBS to industry, technology, science, the Government, and the public.

INTRODUCTION

AS MY contribution to this symposium, I would like first to mention the area of contact between the National Bureau of Standards and the textile industry and then to touch on the functions performed, work in progress, and accomplishments that reflect the services of the NBS to the industry.

Perhaps I should say at the very start that, contrary to a persistent idea, the NBS does not set the standards of the industry. It has no authority to impose and to enforce standards. These functions lie elsewhere in the Government or are left to the voluntary action of producers and users.

We all know that the textile industry in a broad sense is not one but a group of more or less related and competing industries with many facets. The production of natural fibers is one of them, of synthetic fibers another. Other facets include spinning; weaving; knitting; rope and cordage making; dyeing; finishing; distribution, including importing and exporting; selling; drycleaning; laundering; and recovery for reprocessing. Use is an important facet, including as it does use in industry, in institutions like hospitals and hotels, in homes, and in the Federal Government, which is a very large user of textiles.

All of these activities, in spite of their diversity, are concerned in some measure with the properties of textiles, for, as everyone is aware, the value of textiles in commerce and in use depends upon their properties. The work on textiles at the National Bureau of Standards deals very largely with properties and it is in this area that the NBS serves the industry.

The NBS is located in pleasant surroundings in northwest Washington. Its staff is made up predominantly of chemists, physicists, engineers, mathematicians, and technologists, and numbers about 2,400. The Textiles Section has a staff of 15. About one-fifth of the effort of the Section is supported by direct appropriation and four-fifths by transfer of funds from other agencies of the government. Repetitive testing and some other work on textiles is not carried on in the Textiles Section but elsewhere in the NBS.

FUNCTIONS OF THE NBS

Six functions have been assigned to the NBS by Congress.

The basic and unique function is the *custody, maintenance, and development of the national standards of measurement*, ie, the standards of length, mass, electricity, light, color, viscosity, and so on. These standards are essential to the textile industry, just as they are to other industries. This function really needs no elaboration, but I will give one example. The watt-hour meter in your home or your textile mill, on which your bills for electricity are based, is calibrated by comparison with a portable meter carried by the meter reader. This in turn is calibrated with the master standard meter of the power company, and this meter is calibrated with the standard maintained at the NBS. In order to provide an accuracy of plus or minus 1% for your meter, that of the meter reader has an accuracy of about 0.5%, and the meter of the power company, an accuracy of 0.1%. NBS calibrations of watt-hour meters are at present accurate to about 0.02%. To maintain the greater accuracy required in its standards, to meet the demands from industry and from science for increasing accuracy all along the line, and as a basis for new standards, the NBS carries on a continuing program of fundamental research and instrument development.

The *determination of the physical and chemical constants and properties of materials*, another function, is a necessary adjunct to the first. It contributes to advancement in science and technology and to the utilization of the advances by industry and the Government.

The development of *testing methods* grows out of the two previous functions. The testing of materials for Government agencies is a related activity.

The knowledge and experience gained in the first three functions are made available for the *development of standard practices, codes, and specifications*, the fourth function, especially through active cooperation with national associations like the American Association of Textile Chemists and Colorists, the American Society for Testing Materials, the American Standards Association, and so on.

Scientific and technical advisory services, the fifth function, are provided for other Government agencies.

Through the sixth function, the NBS undertakes *special research and development projects for Government agencies*.

More specifically with respect to textiles, the NBS undertakes to advance the science of measurement of fibers, yarns, and fabrics, and investigates their properties and the relationships between their properties, chemical composition, and physical structure. It cooperates with interested organizations in the specification of properties in standards. It has close relations with textile research institutions, professional societies, universities, textile schools, Government agencies, commercial textile-testing laboratories, and the industry. It concentrates its efforts on projects that it is particularly qualified to undertake because of special facilities or experience.

CURRENT WORK ON TEXTILES

The ways in which textile projects arise and are carried out will be evident from a brief review of work in progress.

CALIBRATION OF FADING LAMPS ———NBS maintains a standard light-sensitive paper and standard faded strips of it that are supplied to laboratories operating carbon-arc fading lamps for testing colorfastness to light. These standards enable the laboratories to correct for the variations in fading efficiency of their lamps and to express their results in

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terms of recognized "Standard Fading Hours" of exposure. The papers were developed as a result of the cooperative work on lightfastness that has gone on between the AATCC and NBS for some 30 years.

TEXTILE TESTING———Textiles are tested for conformance with the specifications under which they are purchased by the Federal Government. This service is, of course, of particular value to agencies that do not have their own laboratory facilities. Tests for other purposes are made for the Federal Trade Commission and other agencies. This is a relatively small part of the work on textiles.

DETERIORATION OF TEXTILES ———Most textiles lose strength and may change in color from exposure to light, heat, wetting and drying, and corrosive gases in the atmosphere, and NBS has studied the effects of each of these factors. In spite of the extensive research that has been done in many laboratories our understanding of the reactions involved is still rather limited. Some years ago the deterioration caused by sulfur dioxide in the atmosphere and by ozone was studied. The first causes "laundry winter damage" in wash hung outdoors. Ozone may contribute to weathering. Recently studies have been made on the deterioration caused by exposure to oxides of nitrogen in the atmosphere, one effect of which is "gas fading" of certain dyes on acetate and other fibers. Apparatus for exposing textiles to air of known concentrations of gases at known relative humidities and temperatures has been constructed. The strengths retained by different kinds of cloths after exposure to air containing N_2O_4 for various periods of time are being measured.

Other constituents of the atmosphere may require study in view of the growing problem of "smog".

IDENTIFICATION AND QUANTITATIVE ANALYSIS——— More rapid and accurate methods for the identification and quantitative analysis of textiles and the many nonfibrous materials to be found on them today are required because ordinary chemical methods are too slow and complicated. Spectrophotometric methods are being applied with the expectation that they may meet modern needs of the Government and the textile industry as they already have met the needs of other industries.

INTERNATIONAL STANDARDS ———The need for standard test methods for textiles as a basis for better understanding among the technologists in different countries and for use in international trade is recognized in the US and abroad. The International Organization for Standardization is actively carrying on work in its Technical Committee 38 on Textiles. Twenty-four countries are participating, including the US. The AATCC, ASTM, and NBS are among the American groups participating in this work through the American Standards Association, the American member of ISO.

RESEARCH AND DEVELOPMENT SPONSORED BY OTHER GOVERNMENT AGENCIES———Government agencies, both military and civilian, often sponsor research and development work on textiles at NBS when the Bureau's facilities and experience are particularly suited for the project. Frequently such projects are of a nature that brings them within the scope of the first five basic NBS functions previously mentioned. One current investigation is concerned with the generation of *electrostatic charges in military clothing* and means of inhibiting them. Another is directed toward the development of a method for testing friction and impact characteristics of *cotton sewing thread* as a basis for predicting the sewing efficiency of the thread in high speed industrial sewing. Still another is a program of basic research on the *behavior of fibers, yarns, and fabrics under high speed impact.*

I would like to say a little more about this last named investigation. As a result of earlier work on the shock-absorbing ability of various fibers to be used in safety ropes for window washers and structural workers, equipment was built for measuring accurately the behavior of yarns subjected to longitudinal impact at speeds up to 100 meters per second. With high-speed motion pictures the load-elongation cycle occurring in a few milliseconds can be determined. Even a short length of yarn will break if one end is given a high enough velocity in a short enough time, even though the other end is not held. This "critical velocity" varies widely for the different kinds of fibers. Recently new equipment has been built and put to use in the study of transverse impact on yarns and fabrics. The mathematical treatment of the results is leading to new concepts of textile-fiber properties. Important applications include the development of superior sewing thread for high-speed sewing, safety ropes and belts for structural workers, and special clothing and other textiles for military, aeronautical and industrial uses.

An investigation of the *thermal degradation of cellulose* is being carried on for the Quartermaster Corps. The purpose is to elucidate the mechanisms of the reactions that take place and especially the action of fire retardants, as a basis for a new approach to the development of superior permanently flameproofed textiles. Quantitative studies of the pyrolysis of cotton under carefully controlled conditions are in progress and the mass spectrometer is being used to analyze the products of pyrolysis.

OTHER WORK ——— Nearly every one of the sixteen scientific divisions of NBS is called upon from time to time for work on textiles in its particular field. The Electricity Division is cooperating in the study of *electrostatic charges on textiles.* The Photometry and Colorimetry Section in the Optics and Metrology Division has made many contributions to the solution of textile *color problems.* It is about to publish a comprehensive survey of color names that will provide numerical ratings of the colors in several systems so that colors named in one system may be related to those in another. The testing of *flammable fabrics* is done in the Fire-Protection Section of the Building Technology Division. Help in the use of *statistical methods* in research, control of production, and acceptance of materials is provided by the Applied Mathematics Division. Other examples could be cited.

ACCOMPLISHMENTS

Over 900 papers relating to textiles have been published by NBS during the past 40 years. Several hundred of them contain the results of original research on structure, properties, testing, and specification of textiles.

NBS has served as a *training school* for technical personnel who have later served in the industry and in Government laboratories.

NBS has also served as a training school for organizations. The *National Institute of Drycleaning* grew out of a research associateship at the NBS established at a time when drycleaning had very little technical training and facilities for attacking their common problems. The effectiveness of a central scientific laboratory for the industry became evident and they established their own.

The *Textile Foundation* established its laboratory at NBS and carried on important research work there. Later, as you know, it turned its remaining assets over to the Textile Research Institute when the latter became assured of the continuing support of the industry.

Similar examples could be given of the development of other important research organizations in many other fields from small beginnings in NBS. We take considerable pride in knowing that so many of our pioneering activities in textiles and in other fields have paid such impressive dividends.

Washington Section———

TEXTILES AND THE FEDERAL TRADE COMMISSION*

HARVEY H HANNAH

Division of Wool, Fur and Flammable Fabrics
Federal Trade Commission
Washington, D C

I WELCOME this opportunity to meet and discuss with AATCC members and guests the Federal Trade Commission's part in the textile industry.

My remarks tonight constitute my own views and opinions and are not to be regarded as those of the Commission. The Commission, a quasijudicial body, speaks only through its formal decisions, announcements, and reports.

The Federal Trade Commission, an independent administrative agency, came into being through the enactment by Congress of the Federal Trade Commission Act of 1914 (38 stat 717; USC 41-51). Since this time, the Commission has been charged with additional duties under the Clayton Act, the Export-Trade Act, the Lanham Trade-Mark Act, the Wool-Products-Labeling Act, the Fur-Products-Labeling Act, and the recent Flammable-Fabrics Act. With the exception of its specific responsibilities under the Wool- and Fur-Labeling Acts and the Flammable-Fabrics Act, the Commission's role in the textile industry may be said to be the same as in the other industries which make up our vast present-day economy.

The purpose of the Federal Trade Commission is to protect both business and the public against unfair methods of competition in commerce and to stop those practices which would lessen competition or tend to create monopoly. It is also to guard both business and the consumer against unfair or deceptive trade practices.

In short, the Commission is charged with the basic duty of preserving our private competitive system by keeping competition both free and fair.

The Federal Trade Commission Act lays down a general prohibition against the use in commerce of "unfair methods of competition" and "unfair or deceptive acts or practices." The Clayton Act prohibits specific practices commonly recognized as instruments of monopoly. Under both statutes it is the duty of the Commission to stop in their incipiency practices which are unfair, promotive of monopoly or which tend to substantially lessen competition.

The Federal Trade Commission, in addition to carrying on its war against monopoly, restraints of trade, and unlawful price discriminations, plays another most important role in the textile field. It is charged by Congress with the administration of the Wool-Products-Labeling Act of 1939, as well as the recently effective Flammable-Fabrics Act of 1953. The Wool Act, commonly known as the "Truth in Fabrics" law, provides for mandatory fiber-content labeling of wool products. Under this Act the Commission engages in compliance investigations and industry counseling, issues registered identification numbers, and records continuing guaranties. The Flammable-Fabrics Act, which embraces that portion of the textile field dealing with wearing apparel and fabrics sold and intended for use therein, prohibits the sale and distribution of any such merchandise which is found to be "highly flammable" when tested according to a prescribed standard of flammability set out in the legislation. Rules and regulations under both the Wool Act and the Flammable-Fabrics Act, together with various informative bulletins and pamphlets relating to acceptable methods of compliance, have been published and are available upon request.

Under its trade-practice-conference procedure the Commission has issued trade practice rules for various segments of the textile industry, which rules constitute interpretations of the general prohibitions under the Federal Trade Commission Act.

Basically speaking, the Commission has no authority to punish, its functions being to "prevent" by means of cease-and-desist orders and otherwise those practices inhibited by the statutes which it administers.

The principal functions of the Commission are:

1) To promote free and fair competition in interstate commerce in the interest of the public through prevention of price-fixing agreements, boycotts, combinations in restraint of trade, unfair methods of competition, and unfair or deceptive acts or practices.

2) To prevent the dissemination of false or deceptive advertising.

3) To prevent discriminations in price, exclusive dealing and tying arrangements, corporate mergers, and interlocking directorates when the effect of such practices or arrangements may be the substantial lessening of competition or a tendency toward monopoly; the payment or receipt of illegal brokerage; and discrimination among competing customers in furnishing of, or payment for, advertising of promotional services of facilities.

4) To supervise under the Export Trade Act the registration and operation of associations of American exporters engaged solely in export trade and prevent those operations which may restrain domestic trade or enhance or depress domestic prices.

5) To petition for the cancellation of the registration of trade marks which were illegally registered or which have been used for purposes contrary to the intent of the Trade Mark Act of 1946.

6) To administer the provisions of the wool-, fur- and flammable-fabrics acts.

The Commission's law-enforcement work falls into two general categories:

1) Formal litigation leading to cease-and-desist orders, and

2) Corrective action of a voluntary and cooperative nature.

Law observance obtained through voluntary and cooperative action may be brought about through the Commission's trade-practice-conference procedure, through individual stipulation agreements, or through the acceptance of informal assurances of discontinuance of minor infractions.

In preventing the use of unfair trade practices the Commission makes extensive use of voluntary and cooperative procedures through agency channels established for such purposes. In this respect, a program is currently being followed of encouraging voluntary compliance with the law in every way possible, backed, of course, by vigorous enforcement measures when necessary. Under such a program, business and industry may obtain authoritative guidance and a substantial measure of certainty as to what they may do under the laws administered by the Commission. At the same time, the consumer may also obtain information from the Commission with respect to his rights in dealing with business. In speaking of cooperative corrective measures, the late Chief Justice Hughes, in the Sugar Institute Case before the Supreme Court, said: "Voluntary action to end abuses and to foster fair competitive opportunities in the public interest may be more effective than legal processes."

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The trade-practice-conference procedure of the Commission represents a practical application of the principle of self regulation. It results in the cooperative establishment of rules designed to prevent unfair trade practices in a particular industry, the objective being to bring about law observance on an industry-wide basis. This is achieved by enlisting the cooperation of industry members and other interested parties, including consumers, in a joint attack on practices which are unfair and harmful to the industry itself or to the consuming public. Trade-practice-conference proceedings may be initiated by application of industry or upon the Commission's own motion.

Members of an industry for which a proceeding is authorized are invited to meet with Commission representatives in conference. On the basis of the information and suggestions developed, a draft of proposed rules for the industry is prepared and made available to all concerned for study and comment. Afterwards, at an announced time, all interested persons are given an opportunity, either orally or in writing, to present their views, suggestions or objections concerning the proposed rules. Upon consideration of the proceedings, the Commission then promulgates rules, which specify in detail the industry practices deemed to be unfair and violative of law. The rules define and proscribe such practices. They apply the requirements of the statutes as interpreted by the Commission and the Courts to the problems and practices of the particular industry. Thus, whereas the Federal Trade Commission Act outlaws in general terms "unfair methods of competition" and "unfair or deceptive acts or practices," trade-practice rules translate these general prohibitions of the statute into specific prohibitions of specific practices.

As recently stated by our chairman, the Honorable Edward F Howrey, at an appearance before a section of the American Bar Association, "The trade-practice conference is one — probably the most important one — of the Commission's voluntary procedures whereby the Commission, through consultation and cooperation — rather than prosecution — tries to help business help itself."

Various segments of the textile industry have figured very largely among the activities for which trade-practice-conference rules have been established. Among these are cotton converting; infants' and children's knitted outerwear; upholstery and drapery fabrics; rayon and acetate; linen; narrow fabrics; rayon, nylon and silk converting; ribbon; silk; canvas covers; hosiery; hand knitting yarn; rayon and silk dyeing, printing and finishing; and the shrinkage rules for the woven cotton yard goods industry.

In addition, conference proceedings are presently pending for the corset and brassiere industry as well as that part of the wool industry concerned with shrinkage and washability of wool and wool products.

An application for trade-practice-conference proceedings has been made by certain members of the man-made fibers industry and is also under consideration.

In addition to its activities under the antitrust laws and in connection with its work in the deceptive practices field the Commission is charged by Congress with the administration of three separate and important pieces of consumer legislation, two of which deal directly with the textile industry: the Wool-Products-Labeling Act of 1939, the Fur-Products-Labeling Act of 1952, and the very recent Flammable-Fabrics Act, which became effective in July 1954.

The purpose of these Acts is to afford protection from misbranded wool and fur products and from false invoicing and advertising of fur products and furs as well as from the hazards surrounding the use and marketing of dangerously flammable fabrics and articles of wearing apparel.

The Wool-Products-Labeling Act constitutes "truth-in-fabrics" legislation and generally provides for mandatory fiber-content labeling of products containing wool fibers. It also prohibits false or deceptive labels on woolen products, thereby encompassing the broad field of misbranding. Under the Act fiber-content labels must accompany woolen products from their raw-fiber stage through the processes of manufacture and distribution until the end product reaches the purchaser-consumer. Approximately 70 industries are engaged in the manufacture and distribution of wool products including over 20,000 manufacturers and 260,000 distributors.

As you know, there has been a tremendous development in synthetic fibers over the past ten years. In view of the comparatively high price of wool, this has resulted in a tendency in certain quarters to use wool substitutes without full disclosure of such facts. In addition, there has been a heavy consumer demand for fabrics made in whole or in part from specialty fibers, such as cashmere, vicuna, camel hair, and guanaco. These specialty fibers are in short supply and consequently command a premium price. There have been increasing instances where manufacturers have tried to pass off cheaper substitutes for these high-priced specialty fibers. The use of these substitutes in the textile field may result in deterioration in quality and unscrupulous profiteering.

The unjustified use of wool-connoting terms and trade marks on labels, as well as in advertising, such as "tweed," "worsted," "Shetland," etc, in connection with materials containing no wool whatsoever has created much confusion and is presently the subject of a growing number of complaints.

Through its enforcement of the Wool Act the Commission is endeavoring to give effective protection both to the consumer and the trade against such malpractices.

The Fur-Products-Labeling Act prohibits the use of false, fictitious and over-glamorized names for fur and fur products. It provides in substance that purchasers shall be informed on labels, invoices and in advertising of certain essential facts including the true English name of the animal that produced the fur and its country of origin, if it is imported. If the fur product is composed of used, damaged, or scrap fur or fur that has been bleached or dyed, such facts must also be disclosed. Approximately 7,500 manufacturers and 75,000 distributors of fur products are subject to the provisions of this Act.

In the field of furs, while the use of deceptive and over-glamorized names for furs is almost a thing of the past, certain manufacturers and unprincipled distributors are still attempting to dye or tip-dye their furs without revealing the facts as required by the law.

The new textile fabrics that are being made to simulate fur do not fall within the scope of the Fur Act and hence are not subject to its requirements. The manufacturers and distributors of such fabrics, however, should in all instances represent them as textiles and not as fur. Terms such as "fur fabric" or "man-made fur" would be questionable in that the material is not fur nor is it made of fur fibers.

The Flammable-Fabrics Act, the most recent legislation designed for Commission enforcement, affords protection against bodily harm and hazards incurred in the use of wearing apparel and fabrics sold and intended for use therein, which are so highly flammable as to be dangerous when worn by individuals. Standards for determining dangerously flammable materials are expressly set forth in the Statute. The marketing in commerce of materials that fail to meet the prescribed standard is unlawful. The legislation has already barred from the market place those fabrics and articles of wearing apparel of a highly dangerous nature, such as the so-called "torch sweaters" and "high-pile cowboy suits" of a few years back. Moreover, it has caused many manufacturers and distributors to become extremely flammability-conscious with respect to their products, all in keeping with the intent and purpose of the Statute. The scope of the Flammable-Fabrics Act is even broader than that of both the Wool and Fur Acts combined in that, with minor exception, all wearing apparel — regardless of material, fiber content, or construction — falls within its provisions together with such

fabrics and films as may be sold and intended for use therein.

Violation of any of the three Statutes is subject to a Commission cease-and-desist order. Condemnation and injunction proceedings as well as criminal prosecutions for willful violations are likewise provided for under certain circumstances. Under each of the Statutes the Commission is directed to prepare and issue rules and regulations necessary and proper for the administration and enforcement of the Act. These regulations have been issued and are now integral parts of the legislation. Applications for their amendment as well as for amendment of the Commission-prepared "Fur-Products Name Guide" are received from time to time and given consideration by the Commission.

The issuance and acceptance of guaranties are provided for under the Wool-, Fur- and Flammable-Fabrics Acts. Continuing guaranties which afford protection to all customers of a guarantor may be filed with, and are publicly recorded by, the Commission. Such documents, when relied upon in good faith, may be pleaded as an absolute defense to certain charges of violation of the Acts on the theory that the recipients of the guaranties, being middlemen in the marketing of the goods, should be entitled to receive and pass on the representations of their sources of supply without further testing of the merchandise or incurring liabilities under the Statutes.

Special provisions for importation and exportation of products subject to the respective Acts are made for enforcement by the Customs Bureau and the Commission in mutual cooperation. Compliance checks and examinations including field inspection and industry counseling work are authorized and carried on in connection with the administration of the Acts.

In view of their similarity in purpose and policing requirements, the duties incident to the enforcement of the Wool-, Fur- and Flammable-Fabrics Acts have been integrated in every possible way in an effort to minimize administration costs. During the past year, the staff of investigators employed by the Commission in policing compliance with these Acts has been further decentralized. We now have representatives of the Division of Wool, Fur and Flammable Fabrics permanently stationed in Boston, New York, Philadelphia, Washington, Atlanta, Chicago, Cleveland, St Louis, Dallas, Los Angeles, and San Francisco.

There are many phases of the Commission's responsibilities and activities in the textile field which I should like to discuss in more detail if time permitted. However, I have already exceeded the time allotted me and I wish to thank you for your interest.

Minutes———

185th Meeting
TECHNICAL COMMITTEE ON RESEARCH

THE 185th meeting of the Technical Committee on Research was held at the Chalfonte-Haddon Hall, Atlantic City, N J, on Thursday morning, September 22, 1955.

The program was divided into two parts: first, the regular meeting, in which Committee officials and subcommittee chairmen presented reports, and second, the presentation of results obtained on textiles in the atomic-bomb tests in Nevada this past spring.

Charles W Dorn, chairman, welcomed approximately 200 members and guests, after which he introduced those seated at the rostrum: Matthew J Babey, secretary; Harold W Stiegler, director of research; Charles A Sylvester, secretary; and Leonard S Little, chairman of the Executive Committee on Research.

Mr Little thanked and complimented Messrs Dorn, Stiegler and Fynn for their outstanding work at "Operation Cue."

He reported that three new committees had been formed: Pilling; Soiling; and Resistance of Textiles to Weathering, F J Rizzo, chairman. He also reported that L R Burgess had succeeded George H Hotte as chairman of the Committee on Definitions.

Mr Little asked that each chairman recheck the test procedures of his respective committee to insure that every detail is covered.

It was announced that meetings of the International Organization for Standardization (ISO) will be held just prior to, and possibly during the first day of, the Perkin Centennial celebration, ie, Sept 6-8 and Sept 10 (tentative).

SUBCOMMITTEE REPORTS

ANTIMICROBIAL AGENTS——This Committee met on September 15, 1955 to discuss the final writing of the agar plate test procedure. Results from six cooperating laboratories reportedly have shown excellent correlation, proving the procedure sound.

M Goldsmith, Home Economics Branch, US Dept of Agriculture, Washington, D C, submitted another procedure which is being used extensively in place of the agar plate test method. This method calls for the inoculation of the sample with a stated volume of bacteria in a saline solution, and then incubating for a given length of time in a given volume of sterile FDA broth. The value of the treatment is rated by the turbidity of the broth after incubation. This turbidity is due to the development of bacteria. Various types of fabric will be supplied to Miss Goldsmith to determine the amount of inoculant necessary for these various weights and types of fabric as well as the volume of sterile FDA broth required. As soon as this is completed, a complete procedure will be written, and investigations by the cooperating laboratories will be undertaken.

ANTISTATIC FINISHES——Chairman S N Glarum reported that, in the three years that this Committee has been in existence, two tentative standard tests have been adopted for indicating the tendency of textile fabrics and yarns to accumulate electrical charge. Both of these methods involve measurement of the resistivity of the textile material and are based on the idea that "one cannot hold water in a sieve." "If a material has low resistivity, any electrical charge that is generated can pass readily to the surroundings," he stated. "The test methods as finally adopted are quite simple but, as you know, work of this kind involves a great deal of investigation which never shows up in the final report."

"There is one major factor in problems of static electricity that is not covered in the above tests. This is the tendency of a textile to generate an electrical charge. The Committee has not overlooked this factor and recognizes that the resistivity tests are not all-inclusive. If the resistivity is low, it is certain that the antistatic properties of the textile are good. But the reverse is not necessarily true under all conditions. A textile with high resistivity will not cause static trouble if it has no tendency to take or give up electrons under particular conditions. The charge generation properties of the textile depend not only on the material itself but also on the properties of adjacent surfaces.

"A great deal of data has been collected from many cooperating laboratories on this subject. Almost every laboratory is using a different method of testing which has been developed to suit its specific needs. The results from the different laboratories do not show too close agreement, although in a majority of cases the general conclusions agree fairly well with the results of resistivity tests.

"The majority of the Committee feels at this time —

1) That the measurement of the charge-generating properties of fibers is of interest mainly to manufacturers of new fibers. It can be established quickly in practical usage whether a given fiber presents problems in this respect. Thus, it seems unnecessary to establish AATCC test methods for this purpose.

2) That the resistivity methods adopted are adequate in the vast majority of cases for evaluating finishes for fibers which present static problems.

"The Committee will continue to give consideration to new data that becomes available and to any proposed methods of measuring charge generation, but for the present no active program is planned on the development of such a method.

"At present, the committee has in progress a program of interlaboratory testing of the aging problems that may be encountered with antistatic finishes.

"The comments and suggestions of the Technical Committee on Research are requested for guidance of the future activities of the Antistatic Finishes Committee."

STANDARD DEPTHS OF SHADES FOR DYESTUFF FASTNESS EVALUATION———Chairman M J Babey reported that, after two years of interlaboratory work, this Committee will recommend adoption of the 18 new ISO European standard depths. The Committee used twenty known dyes to match these depths. It has been proven possible for different laboratories to match to the standard depths with very little variation. The Committee suggests one sixth the standard depth for the pale shade and three times the standard depth for the heavy shade.

WATER ABSORBENCY ——— Chairman Ralph B Smith reported that J B Mellor of Cone Mills, Inc had submitted a report covering all the work he had done on water absorbency using the wire-screen method. This report was circulated to the Committee and it was the consensus that Mr Mellor's method showed promise and should be further investigated. An instrument will have to be built.

FLAMMABILITY OF CLOTHING TEXTILES ——— Chairman H E Hager outlined the history of this Committee, which was organized ten years ago. He pointed out that the test method and instrument it had developed, although not perfect, had been adopted and used under Federal law. He stated that the method gave excellent results in the testing of flat fabrics, but in testing pile fabrics, some variables are encountered. In reply to G Buc, who called attention to some of the inadequacies of the test, Dr Hager assured the group that the Committee will continue to study the matter.

EVALUATION OF FIRE-RESISTANT TEXTILES———L L Heffner, chairman pro tem, expressed the Committee's sorrow regarding the death of its chairman, James R Redmond on April 9, 1955. Although indications are that further work at this time is not desirable, a meeting is planned to determine if any vitally interested individuals or groups would require additional work on test methods in this field.

FASTNESS TO LIGHT———R C Allison, chairman, outlined the work on the replacement of the Wool Blue Standards. He pointed out the difficulties in dyeing these standards, and praised Frank J Rizzo for his work along these lines.

It was reported that New Calibration Papers 1589 and Booklets of Faded Standards will continue to be supplied as usual by the National Bureau of Standards, but at a slight cost.

The Committee will evaluate visually the many exposures which have been made by Charles Seibert at his home in Salem, N J, under various conditions during the past two years.

Under the leadership of C H A Schmitt, the subcommittee investigating sunlight and the value of UVSH has completed its preliminary and first-month exposures. It will meet and discuss the results prior to undertaking further work. Testing is being carried out at South Florida Test Service, Miami, Fla; Desert Sunshine Exposure Tests, Phoenix, Ariz, under the direction of C Caryl; and Atlas Electric Devices Co, Chicago, Ill, under the direction of J E Norton.

Plans are also underway to evaluate the tentative ISO Daylight Method, which uses the European Blue Standards. The method of evaluating differs from that used by AATCC.

Work is also being carried out on various types of different light sources for possible use in artificial fading.

STANDARD SOIL———O C Bacon stated that the report on standard soil for cotton has been written and is being circulated for approval.

STANDARD TEST FABRICS——— G W Wernz, chairman, reported that this Committee has submitted for approval to TCR the first standard six-fiber test cloth using warp threads of type-81 Orlon. It was decided to use the Orlon warp rather than nylon because of the latter's tendency to stain during testing. The Committee believes that it has produced a cloth that is more appropriately designed for its end use. It is now ready to file a specification for repeat production of this item covering yarn qualities, properties, construction and finishing conditions.

A specification for standard Crockmeter cloth has also been submitted for filing.

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Prior to the presentation of the second part of the program, Dr Stiegler was called upon for a review of the work of the AATCC research staff at Lowell and how it functioned with the various subcommittees. He praised the staff for its outstanding job in preparing the exhibit relative to "Operation Cue," and also praised the research committees for their "tremendous" work. He called attention to the fact that the committees are composed of specialists in their fields.

AATCC PARTICIPATION IN "OPERATION CUE"

The second part of the program consisted of a presentation of results obtained on textiles in atomic-bomb tests conducted in Nevada in the spring of 1955.

Mr Dorn, in his introductory remarks, pointed out that AATCC had been presented with a Public Service Award by the Federal Civil Defense Administration. Similar individual awards were given to Messrs Dorn, Fynn and Stiegler.

Mr Dorn thereupon introduced P J Fynn, who described details of "Doom Town" and Ground Zero, using color slides. Mr Fynn also showed views of Camp Mercury, operational base for the Nevada test site.

The initial slides showed the dwellings which were erected to simulate as closely as possible ordinary normal living, with each as completely furnished as possible. Food, furniture and clothed mannequins in typical positions were used inside each dwelling. Various types of fabrics and colors comprised the clothing.

Twenty-four additional mannequins were left standing unprotected in the desert in three rows of eight — four "men" and four "women." The first row was 7000 feet from Ground Zero, the second, 8000 feet, and the third, 9000 feet. The selection of these distances from

Ground Zero was based on the calculated thermal effects of an explosion of expected yield equivalent to 40 kilotons of TNT. An atomic explosion of this size develops thermal radiation which, at 7000 feet, has an intensity of 12 calories of heat energy on every square centimeter of surface. Although a blazing noon-day sun delivers about 1 calorie per minute on every square centimeter, the short duration of the atomic flash makes the rate of supply of energy to a surface many times that of sunlight, and is intense enough under these conditions to make heavy cotton twill burst into flames. As the distance from Ground Zero increases, the energy falls off at a geometric rate so that the radiation which is 12 calories per square centimeter at 7000 feet is about 8 cal/cm^2 at 8000 feet and approximately 5 cal/cm^2 at 9000 feet. It was desired to arrange the three stations so that the first line would be "well done," the second line "medium rare" and the third line scarcely touched.

Because of the violent blast effects that exert wind pressure many times greater than the most vicious hurricane, the mannequins had to be secured in position. For this purpose one-inch pipe was driven three feet into the ground, and the mannequins were wired to this at the chest, waist and knees. They were spaced between the racks on which were mounted the fabric plaques of the rest of the textile project.

The torso of each outdoor mannequin was coated with a heat-sensitive paint, which changes color when exposed to elevated temperatures. They were dressed in various types of garb, complete with underwear, using as wide a variety of fibers as were available in stock garments.

The "bomb" was installed in a room about 25 feet square on top of a 500-foot steel tower. Strictly speaking, it was not a bomb, but a nuclear device, the difference being that a bomb is a self-contained device capable of being used against an enemy. Some of the tests in this series were weapon-type devices, but this one was practically buried in instruments and the exact location and exact moment of detonation had to be known.

Mr Fynn concluded his presentation with slides showing the damage done by the blast to the dwellings as well as to the clothing and the mannequins.

Dr Stiegler, following Mr Fynn on the program, thereupon presented his report.

TEXT OF DR STIEGLER'S REPORT

INTRODUCTION ——— The authorization by the Atomic Energy Commission of the Federal Civil Defense Administration to share in Operation Teapot, Nevada, 1955, resulted in an "open shot" designated by FCDA as "Operation Cue." Through FCDA, industry was given opportunity to participate. The courtesy of the Federal Civil Defense Administration in extending an invitation to the American Association of Textile Chemists and Colorists to sponsor the textile program of "Operation Cue" offered a very practical opportunity to obtain first-hand data on the effects of thermal radiation from atomic detonations on various fibers and fabrics, such as might be worn by populations subjected to atomic bombing.

Mr Dorn, vice chairman of AATCC's Executive Committee on Research and chairman of the Technical Committee on Research, participated in the 1953 tests. At that time fully dressed mannequins were furnished by the J C Penney Company and the Darling Company and exposed in homes, cars and trailers to an atomic detonation. Mr Dorn's leadership was again utilized in the 1955 tests. The AATCC director of research was appointed project officer for textiles, with the invaluable aid of Messrs Dorn and Fynn as project consultants. The immeasurably valuable and vital interest, experience and guidance of S J Kennedy, chief, Clothing and Footwear Branch, Quartermaster Research and Development Command, A J McQuade, head of the Functional Finishes Section of this Branch, and David Feldman of this Section, who was designated observer and technical consultant, provided most effective advisory aid and cooperation. The Association expresses sincere and grateful appreciation for this courtesy.

Plans were made months in advance with regard to the nature of the materials and how they were to be exposed on the Nevada Test Site. Constant liaison was maintained with FCDA officials to integrate AATCC plans and activities, ie, Benjamin C Taylor, Program 31 director; Kyle P Laughlin, project officer, Thermal Effects Programs, and Leonard Lieberman, industry. This group and organization functioned exceptionally well under the trying conditions of integrating so many industrial efforts and materials along with unpredictable uncertainties, such as weather, dates and multitudinous demands.

The objectives of these tests were to develop information about the behavior of textiles when subjected to the high thermal energies of atomic detonations. The information sought included the reaction of textile materials to various heat intensities and quantities with respect to physical change and appearance, such as color, scorching, melting and burning. Furthermore, it was of interest to determine in a general way the degree of heat penetration through clothing to the skin of the wearer.

Much is known, from laboratory data, about the behavior of textiles subjected to heat. Some fuse or melt at comparatively low temperatures. Others scorch, char or burst into flame in successive stages. Melting and fusing of the molten mass to the skin are very dangerous. Charring with continued after-glow is also dangerous.

Since ordinary laboratory-attainable temperatures do not approach those produced by the thermal energies of atomic fission, more information was sought concerning the effect of these extremely high temperatures by actual exposure of materials to the explosion of an atomic device.

It is well known that dark-colored textiles absorb more heat than lighter shades, which reflect greater amounts of radiation. It is also known that the molecular configurations of certain dyes absorb more heat radiation than others.

A matter of primary concern is heat penetration through several *layers* of fabric materials rather than through a single layer. The effect of multilayers of different types of fabrics and fibers is more realistic with respect to clothing than is a single layer. The subject of civilian apparel and the protection afforded by it in the special aspects of atomic thermal exposure is a worthy study.

EXPERIMENT DESIGN ——— The present experiments were designed to obtain data on:

1) *Outdoor* exposures of not only typically clothed mannequins but of multi-layered specimens of fabrics on racks.
2) *Indoor* exposures of clothed mannequins and furnishings in houses and trailers, beyond that previously developed.

1) *Outdoor exposures.* These were set up to include a large range of fabrics and fibers available to the public. The multilayered fabrics were mounted on one-foot square wooden plaques and also exposed in garments on mannequins.

Because individuals are generally clothed in from one to three or more layers of material comprising outer, intermediate and undergarments, several layers of different fabrics were mounted on the plaques to parallel the effect of clothing layers on persons, both male and female.

To simulate the effect of folds and air space between garments, one half of the surface of each wooden plaque was recessed one quarter of an inch. This left an air space under one half of the mounted textile material while the other half rested on the solid wood surface of the plaque.

The plaques were painted with a heat-sensitive paint to give an approximate estimation of radiation penetrating through the fabric layers. In addition, a dozen temperature-indicating papers were placed on each quarter section of the plaque. This arrangement provided information about temperatures under single and un-

der multiple layers, with and without air space.

After fabric specimens were fastened to the plaques, ten plaques were nailed to each of thirty collapsible wooden racks, nine feet long by five feet wide.

The racks were placed in three rows of ten each facing the bomb tower. They were anchored to the ground with cables and iron stakes to resist the blast. The upright portions, on which the plaques were nailed, were held up in place by nylon cords chosen to break with the shock wave and allow them to collapse to the ground. This avoids damage to the fabrics and racks. The thermal pulse, having preceded the shock wave by seconds, has already accomplished its effect on the fabrics.

The ten racks in the first row (100 fabric specimens) comprised the first station which was 7000 feet from ground zero. Identical set-ups were placed at 8000 and at 9000 feet from ground zero.

More than twenty types of fabrics were exposed including natural and synthetic fibers available on the market. In many cases each type of fabric was exposed undyed or white and dyed pastel, medium and dark shades to allow a study of progressive increase in thermal absorption by the darker shades. Included were a direct cotton black and a sulfur black known to have different thermal absorption. Various prints were included. Fabric weights varied from lightweight men's and women's wear to somewhat heavier types likely to be worn by civilians, such as gabardines, twills, denims, men's wool suitings, etc. Resin-treated rayon, cotton, fire-resistance-treated cotton, and asbestos were included.

Where the *top* layer was men's shirting or sports wear, the *under* layer (covering only half of the plaque) was standard knitted white cotton undershirting or cotton shorts material. In some cases cotton-wool knitted underwear material was used. The highest number of layers used in any case was four.

Where the *top* layer was women's dress or sports wear material, the *under* layer was nylon or acetate slip, brassiere or pantie material. In some cases lastex girdle material formed a third or fourth layer.

Twenty-four fully dressed mannequins were firmly staked to the ground, eight (four male, four female) at each of the three stations. The third and fourth male and female were identically clad but the fourth was covered with a white sheet to note the protective action of white coverall. The clothing on the mannequins in general gave the same picture obtained on the plaques.

2) *Indoor exposures.* These were limited to textiles on mannequins, which were placed in houses and trailers.

RESULTS IN GENERAL———Shortly after the atomic detonation, examination of the plaques was undertaken at the three stations of 7000, 8000 and 9000 feet from Ground Zero.

Confirmation of the effect of light and dark shades on thermal absorption was apparent at the first station (7000 feet from the burst). The white cotton fabrics reflected the thermal pulse. Medium shades reflected less and dark shades caused a burning away of the fabrics. Even dark wool was weakened, harshened and embrittled whereas white or light shades of wool showed no damage.

Melt-spun synthetics and acetate tended to melt and drop away or fused and shriveled to a hard mass when cooled. Dark shades again were damaged more than light shades. Even though these melt-spun and acetate fabrics melted and in some cases cused to the white cotton underlayer it was hardly singed.

Underlayers of nylon and acetate, under dark colored prints, melted or showed scorching. The dark design was reproduced on the nylon or acetate.

In general, the second and third stations, at 8000 and 9000 feet from Ground Zero, confirmed the effects obtained at the first station at 7000 feet but to a correspondingly less degree.

* * * * *

NOTE: Complete evaluation of the many combinations of fabrics on the exposed plaques is almost finished and temperature indications are being interpreted. Complete details will be published after the final report is submitted and FCDA approval of material for release is received.

Results in this preliminary report hold only for the conditions, intensities and distances obtaining in the "Operation Cue" open-shot tests. The results must not be regarded or applied from the viewpoint of over-all civilian defense, since they are without status and do not constitute in any way official protective measures against thermal radiation from atomic bombs or devices. Such measures are issued officially by and with the authority of the Federal Civil Defense Administration.

Respectfully submitted,
MATTHEW J BABEY, *Secretary*

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GENERAL CALENDAR OF COMING EVENTS

AMERICAN SOCIETY FOR TESTING MATERIALS
Feb 27-March 2—Committee Week, Hotel Statler, Buffalo, N Y; June 17-22—59th Annual Meeting and 12th Apparatus Exhibit, Chalfonte-Haddon Hall, Atlantic City, N J; Sept 16-22—2nd Pacific Area National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles, Calif.

COMMERCIAL CHEMICAL DEVELOPMENT ASSOCIATION & CHEMICAL MARKET RESEARCH ASSOCIATION
Joint Meeting—Nov 14-15, Carter Hotel, Cleveland, O.

DELTA KAPPA PHI FRATERNITY
Nov 18—Vega Restaurant, Norwood, Mass.

THE FIBER SOCIETY
Spring Meeting—May 2-3, The Clemson House, Clemson, S C; Fall Meeting—Sept 6-7, Warwick Hotel, New York, N Y.

MANUFACTURING CHEMISTS' ASSOCIATION, INC
5th Semiannual Meeting and Winter Conference —Nov 22, Statler Hotel, New York, N Y.

NATIONAL COTTON COUNCIL OF AMERICA
7th Annual Cotton Research Clinic—Feb 15-17, Pinehurst, N C.

PERKIN CENTENARY
May, 1956—London, England.

PERKIN CENTENNIAL
September 10-15, Waldorf-Astoria Hotel, New York, N Y.

PHI PSI FRATERNITY
Annual Meeting—April 19-21, Alabama Polytechnic Institute, Auburn, Ala.

PLANT MAINTENANCE & ENGINEERING CONFERENCE
Jan 23-26—Convention Hall, Philadelphia, Pa.

THE QUARTERMASTER ASSOCIATION
Annual Convention—Oct 27-28, Conrad Hilton Hotel, Chicago, Ill.

SOUTHERN TEXTILE EXPOSITION
19th Exposition, Oct 1-5, 1956, Textile Hall, Greenville, S C.

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION
Nov 9 (Hotel Commodore, New York, N Y).

TEXTILE RESEARCH INSTITUTE
1956 Annual Meeting—March 22-23, Hotel Commodore, New York, N Y.

TEXTILE TECHNICAL FEDERATION OF CANADA
5th Bi-annual Textile Seminar—June 5-7, Queen's Univ, Kingston, Ont.

BOOK REVIEWS

ORGANIC SYNTHESES— Collective Volume III

E C Horning, editor-in-chief
John Wiley & Sons, Inc
440 Fourth Ave, New York 16, N Y
x + 890 pp; 16 x 23 cm; price: $15.00
(1955)

This is a single volume edition of the material in annual volumes 20 through 29 of Organic Syntheses, revised and brought up to date with new and improved methods of preparation. Errors found since the original printing in single volume form have been corrected. Modifications and improvements in procedures have been incorporated. In many cases where industrial chemical progress has made the products described in the annual volumes available cheaply, this fact is indicated although full details for the preparation are still included. The references have also been brought up to date.

Among the substances whose preparations are given, and which may be of interest to textile chemists, are numerous compounds which might serve as dye intermediates. The only intensely colored substances whose preparation is described are p-phenylazobenzoic acid, pyocyanine, and tetraphenylcyclopentadienone. The preparation of terephthalic acid, a substance useful for making fiber-forming linear polyesters, is described. The preparation of undecyl isocyanate, a hydrophobizing agent for naturally occurring polymers, is given. The six different indexes are particularly useful.—AS

THE MODERN TEXTILE DICTIONARY

George E Linton
Little, Brown & Co
34 Beacon St, Boston 6, Mass
xxii + 772 pp; price: $12.50
(1954)

The aim of the author, as expressed in the preface to "The Modern Textile Dictionary," was "to cover correctly all the salient high points of the Industry"; with the inclusion of some twelve thousand terms, he has indeed succeeded. Terms and phrases are included which cover varied and far-reaching areas of the textile industry: manufacturing, from fibers to finishes; clothing, from the history of costumes to spot and stain removal; and management and labor. These terms include trade names which have become household words, foreign as well as domestic words, and some terms which are peculiar to a certain segment of the country.

The fields of style and costume and fabric design are covered in minute detail; in fact, the "definition" of "Costume, History of" forsakes the dictionary idea and approaches the encyclopedic with approximately 13 pages of discussion. The author's background as textile editor for *American Fabrics* is very much in evidence with the complete coverage given to these fields.

The dictionary is a good general reference book; it is not a technical manual. There is some inconsistency in the level of definition and discussion of some of the terms but this does not impair its intended purpose — that of a general purpose dictionary.—DHP

THE TECHNOLOGY OF SOLVENTS AND PLASTICIZERS

Arthur K Doolittle
John Wiley & Sons, Inc
440 Fourth Ave, New York 16, N Y

This book covers various aspects of solvent and plasticizer utilization including production of plastics, coatings, fibers, and adhesives; their formulation and application; handling, storage and shipping of raw and finished products.

Theoretical sections dealing with viscosity and solvent action, solvent recovery and mechanism of plasticization should be of particular interest to the chemist and chemical engineer. Sections concerned with technology are especially useful to the formulator, producer and user of plastics, protective and decorative coatings, adhesives, and synthetic fibers. Although few formulations are listed by the author, sufficient information is furnished the reader to cope with specific formulating problems without placing undue emphasis on his level of technical training.

Complete data are given on approximately 160 solvents and 130 plasticizers, both individually and grouped in tabular form. The behavior of systems utilizing these materials is studied over a range of components and variables and the results graphically illustrated.—RWE

CELLULOSE AND CELLULOSE DERIVATIVES—PART II

Emil Ott, Harold Spurlin and Mildred Grafflin
Interscience Publishers, Inc
250 Fifth Ave, New York 1, N Y
Price: $12.00

Part I of Volume V on cellulose is concerned primarily with the occurrence, chemical nature and structure of cellulose and cellulose fibers with emphasis on the theoretical. Part II on the other hand is concerned with the more practical aspects of pulping, bleaching, and purification (with emphasis on the properties and treatment of pulp for paper), and with the large family of cellulose derivatives.

Discussions on the familiar pulping processes (sulfite, soda, kraft) include not only process descriptions but theory and limitations as well. Several short chapters are devoted to cellulose isolation from sources other than wood, such as cotton lint and linters, rags, bast fibers, cereal straws and grasses. Bleaching and further purification for "permanent" papers is discussed in detail, as is the theory and practice of beating.

About 70% of the book is devoted to the derivatives of cellulose. Process description, reaction mechanism, and properties are included for the more common inorganic and organic esters and descriptive material is also given for the less common esters, such as sulfate, phosphate, acrylate, methacrylate, carbonate, sorbate, chloroacetate, alkoxyacetate, benzoate, oxalate, phthalate, succinate, carbamate, etc.

Reaction of alkalies with cellulose is considered in detail including theories of swelling and mercerization and its effect on structure and properties. The cuprammonium complexes and cellulose-organic base complexes are discussed briefly.

The preparation and properties of cellulose esters, such as ethyl-methyl- and benzyl cellulose are taken up in detail together with carboxymethylcellulose and hydroxyethylcellulose. The section devoted to cyanoethylation is disappointingly brief and includes only the chemistry of the process.

The viscose process (xanthates) is discussed, data are supplied on the effect of xanthation conditions on xanthation rate, sulfur distribution, filterability, and the chemistry and reaction mechanism are described in some detail.

This book, like others in the series, is basically a reference work and contains an extensive bibliography covering the fields discussed. While the wealth of detailed information included will appeal to the specialists in cellulose and paper, its comprehensive treatment, clear presentation and readable style throughout should make it a useful and valuable reference work for all whose interests touch on the field of cellulose in the textile, paper, and plastics industries.—GRG

PAPER CHROMATOGRAPHY —2nd revised and enlarged edition

Friedrich Cramer, Univ of Heidelberg
Translated by Leighton Richards
St Martin's Press, Inc
103 Park Ave, New York 17, N Y
xii + 124 pp; 16 x 23 cm; price: $5.00
(1954)

Those who have had no previous experience with the technique of paper chromatography may find this book valuable. However, the experienced user of chromatography may find that it tends to recount much that is already familiar. Those interested in synthetic linear polymers may be interested to know that hydrolysates of nylon, perlon and polyurethanes may be separated and identified on the paper chromatogram. The use of paper chromatography in the separation and identification of individual amino acids in a protein hydrolysate (for example, from wool) should be well known to textile chemists.—AS

MANUAL OF INDUSTRIAL WATER—2nd Printing

ASTM Special Technical Bulletin No. 148
Prepared by ASTM Committee D-19 on Industrial Water
American Society for Testing Materials
1916 Race Street, Philadelphia, Pa
430 pages; price: $5.00
(Sept, 1954)

This is the second printing of the ASTM Manual on Industrial Water, a publication which includes a broad discussion on the nature and uses of industrial water, plus up-to-date test methods and specifications developed by leading authorities in the field. The Manual was prepared and revised by Committee D-19 of the American Society for Testing Materials.

The general discussion, comprising eight chapters on specifications, sampling methods, definitions, test methods, etc, is essentially identical to the first printing (1953). New material includes the following methods: chemical oxygen demand of industrial waste water; odor, oil matter, pH, and sulfides in industrial waste water; chlorine requirement of both industrial water and waste water; residual chlorine, nitrate ion, sulfite ion in industrial water; determination of thickness of internal deposits on tabular heat-exchange surfaces; and one scheme for analysis of industrial water and industrial waste water.

In addition to the 11 new test methods and 8 revisions of existing methods, a complete table of contents and a detailed index have been incorporated into the Manual.

"The Manual on Industrial Water (2nd Printing)" should continue to serve as an authoritative, up-to-date reference for the following: executives and plant designers; individuals engaged in industrial operations involving the use of water; and analysts, operators of special instruments, engineers and consultants. The reviewer has used the Manual as a reference to supplement notes and assignments in a quantitative course which includes industrial water analysis.—EPJ

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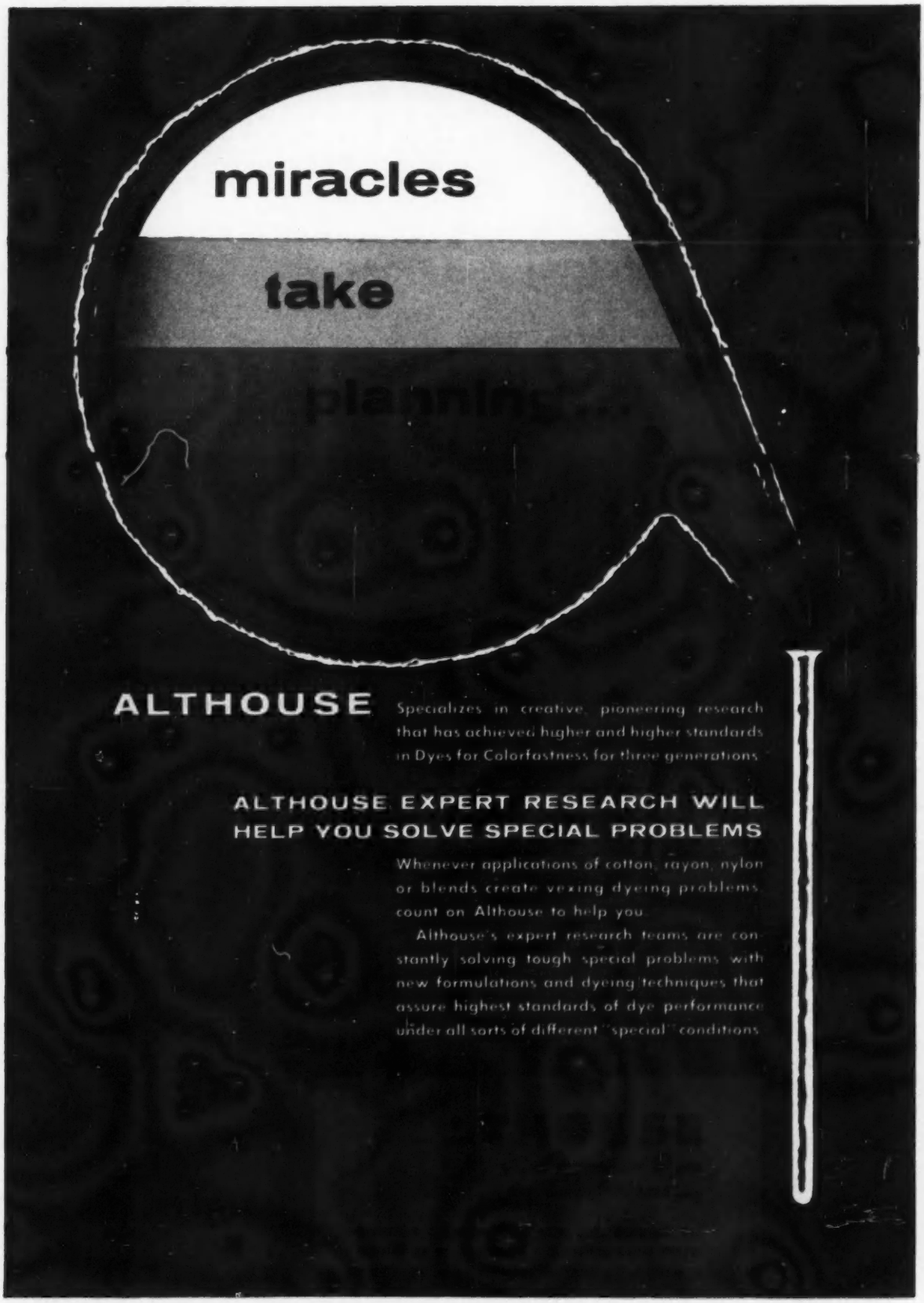
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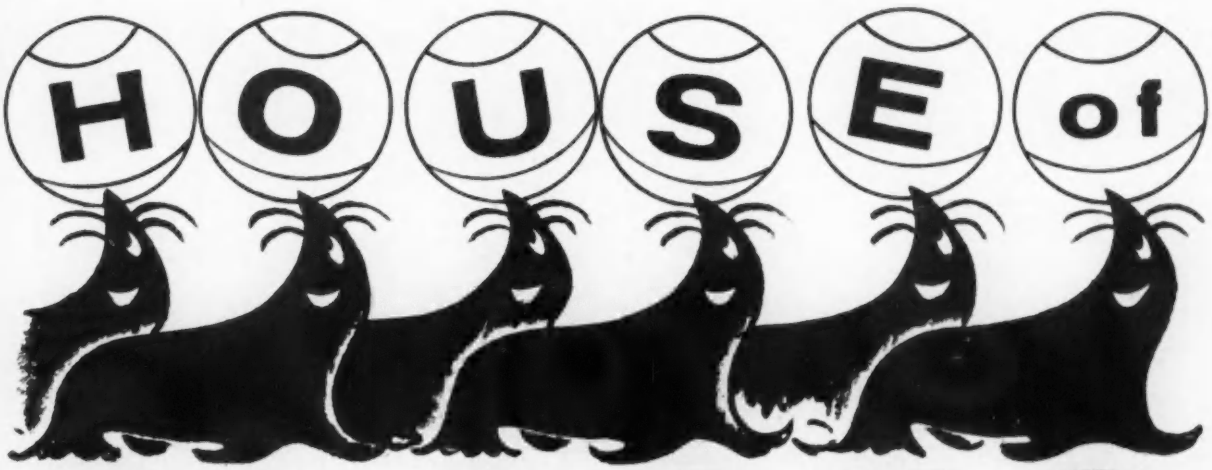

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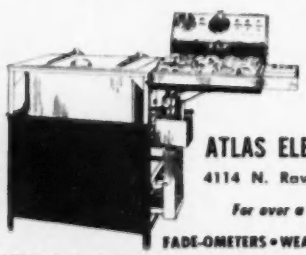

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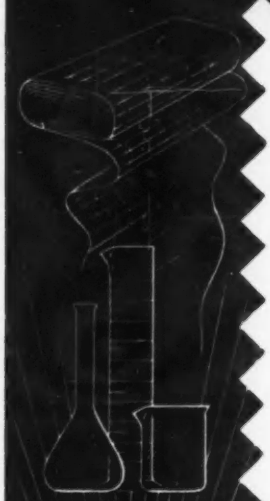

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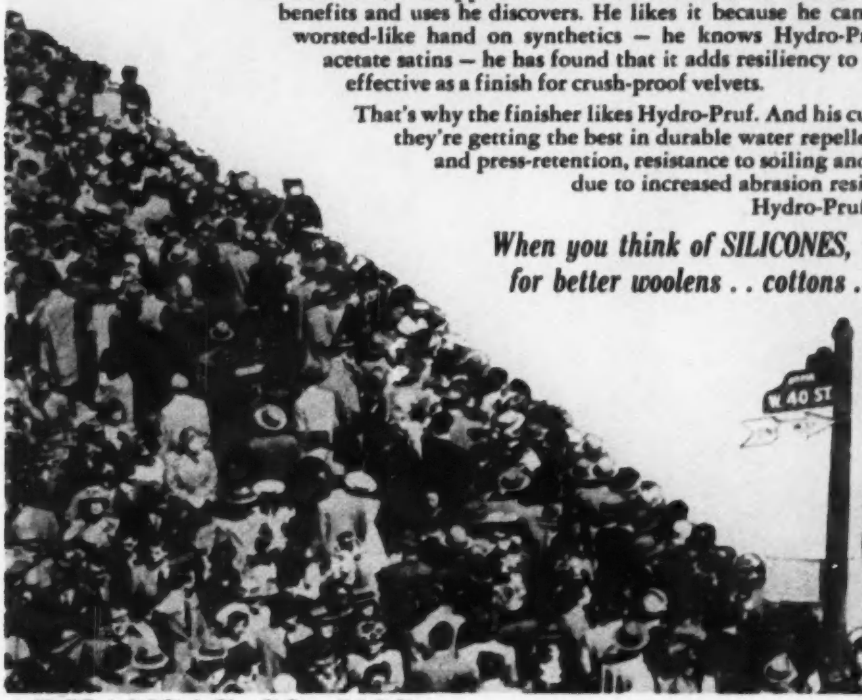

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